

Solar Development in Ohio

Trends, Processes, and Legal Issues with Solar Energy Development:

Session 3: Connecting to the Electric Grid

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Spring Webinar Series

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Presenters

CFAES

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Agritourism Law

Animal Law

Energy Law

Environmental Law

Farm Finance Law

Estate & Transition Planning

Farm Leasing Law

Farmland Preservation Law

Food Law

Line Fence Law

Nuisance Law

Premises Liability Law

Property Law

Roadway and Equipment
Law

Tax Law

Water Law

Zoning Law

Internet Resources

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RENEWABLE ENERGY

Utility-Scale Wind and Solar Facility Siting: Ohio's New Law -- Hall and Romich, 2021

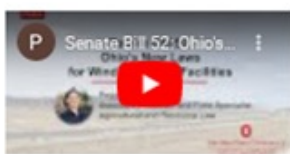


Decommissioning Large Wind and Solar Utilities: Ohio's New Law -- Romich and Hall, 2021

Land Use Conflicts Between Wind and Solar Renewable Energy and Agricultural Uses, A National Agricultural Law Center Report - Hall, Morgan and Richardson, 2021

Farmland Owner's Guide to Solar Leasing -- Hall, Bachelor and Romich, 2019

The Farmland Owner's Solar Leasing Checklist -- Hall and Bachelor, 2019

VIDEO SERIES ON SENATE BILL 52, OHIO'S NEW RENEWABLE ENERGY SITING LAW

 <p>Overview of Senate Bill 52</p>	 <p>Restricted Area Designations and Referendum</p>	 <p>Local Involvement in Project Review</p>
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for our solar resources
and webinar recordings.

Additional solar energy
resources are available at
go.osu.edu/farmenergy.

OSU Extension Ohio Solar Development 2023 Webinar Series

Session #1

Solar Energy
Overview &
Trends

Session #2

The Solar
Development
Lease

Session #3

Connecting to the
Electric Grid

Approval to connect to the grid is a necessary and critical part of the solar development process. We'll provide an overview of the electric utility system, regulatory jurisdiction, and interconnection procedures and timelines.

Session #4

Solar Project
Approval in
Ohio

Session #5

Pre & Post
Construction
Considerations

NREL Solar Technology
Cost Analysis:

<https://www.nrel.gov/solar/market-research-analysis/solar-cost-analysis.html>



Lease Agreement: Developer must show evidence of **site control**.

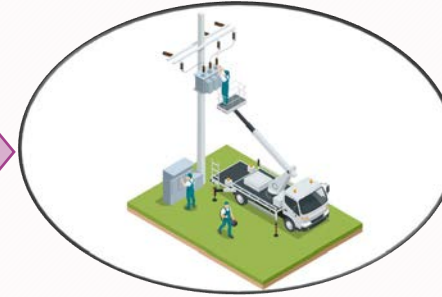
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Critical Layers of Solar Development Regulatory Oversight

1

Approval to
Interconnect
to the Power
Grid

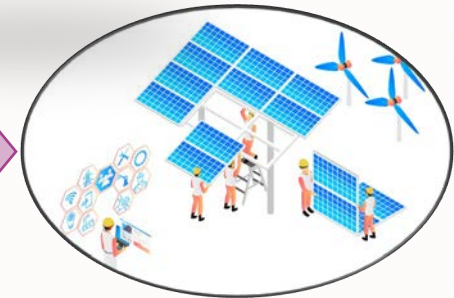
- Public Utilities Commission of Ohio
- PJM



2

Permit to
Construct,
Own, and
Operate

- Ohio Power Siting Board
- County Restricted Zone
- Local Zoning



3

Qualified
Energy Facility
Tax Exemption

- Ohio Department of Development
- County Commissioners



What is your role in this webinar today?

- Local government leader
- State government leader
- State or local government agency professional
- Interested local resident
- Landowner considering a lease
- Extension professional
- Solar industry official/worker
- Attorney
- Agricultural professional
- Other





Program Objectives

- Electric Utility System Overview
- Distribution Grid Interconnection
- Transmission Grid Interconnection
- Federal-State Regulatory Jurisdiction
- Questions, and Discussion

Electricity in Ohio:

Understanding the Physical Infrastructure and
Regulatory Environment



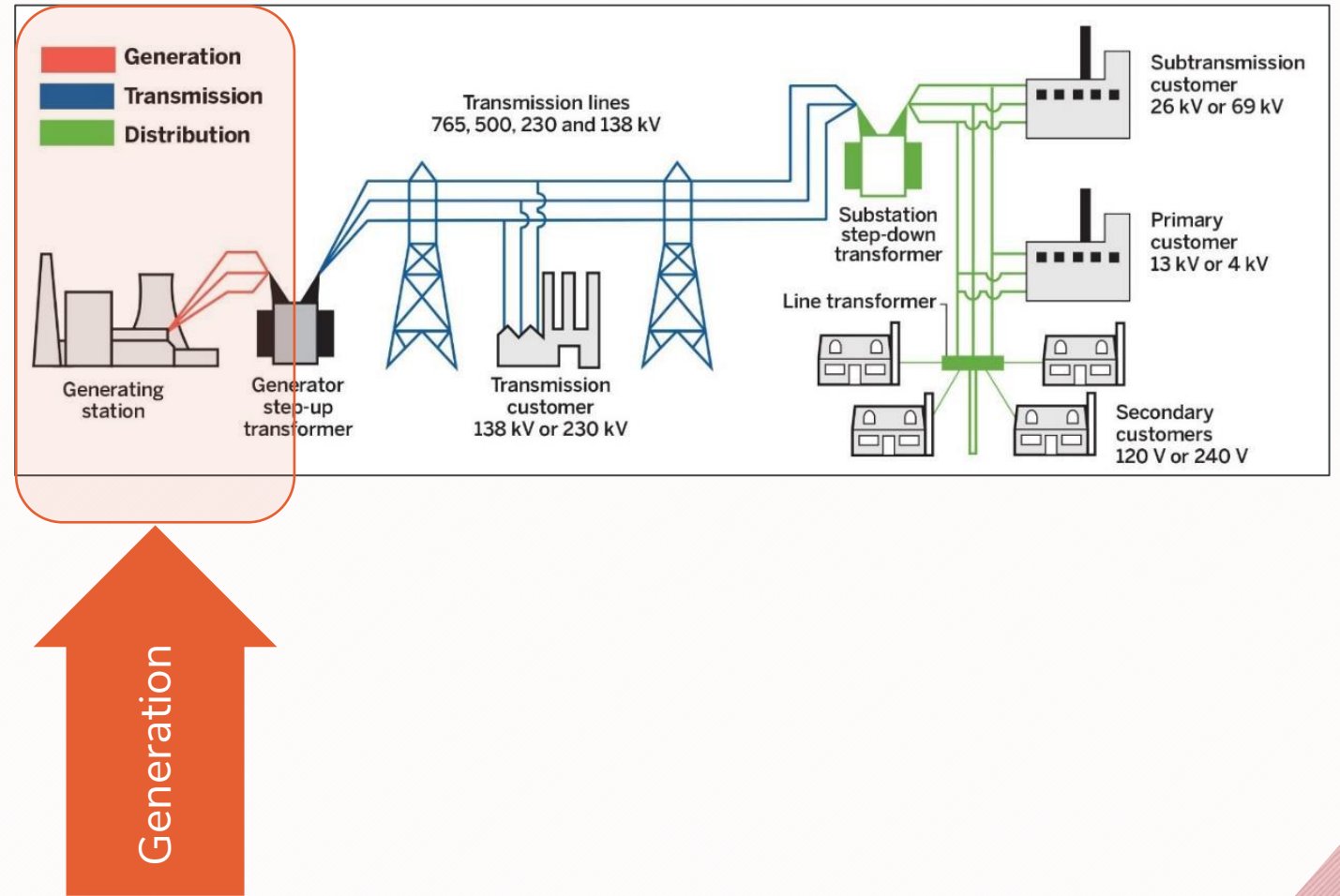
History of Ohio's Electricity Regulation

- The Ohio Electric Restructuring Act (SB 3) in 1999 deregulated the electric power industry in Ohio.
- Restructuring **required electric utilities to separate or “unbundle”** services for electricity generation, transmission, and distribution and to allow retail customers to choose their electric retail suppliers.
- SB 3 ensured that the IOUs **retained their spatial monopoly status** for electric transmission and distribution services within their respective regions – meaning that intrastate transmission and retail distribution remained under the PUCO's regulatory authority.
- Electric cooperatives are not regulated by the state and were not required to restructure under SB3.



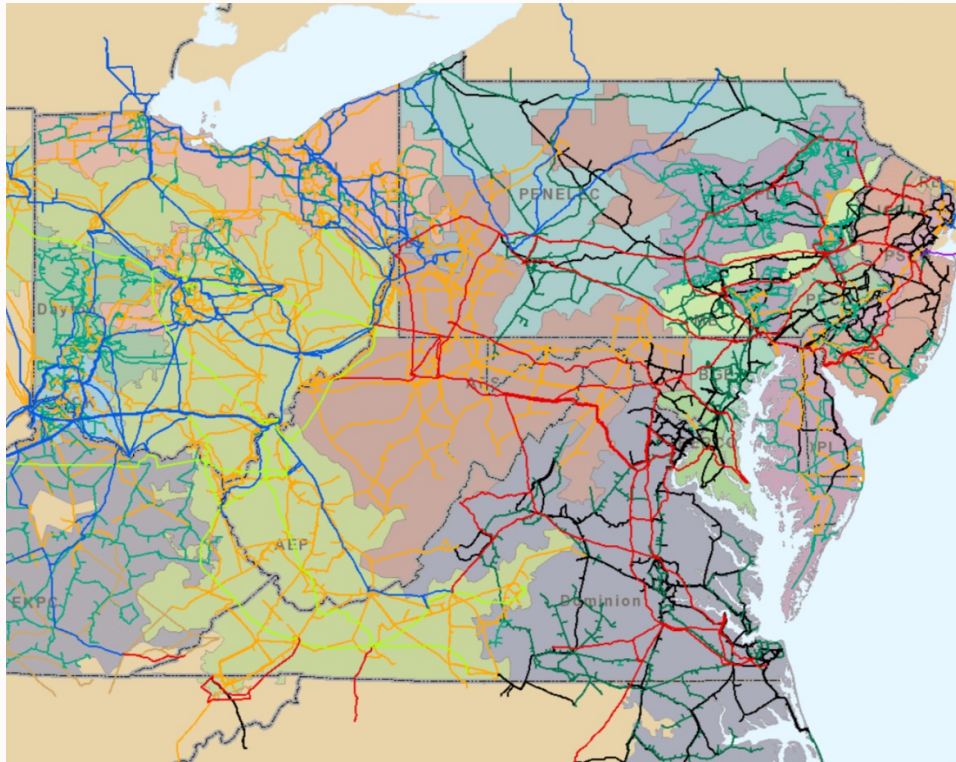
Overview of Electric Utility System

CFAES

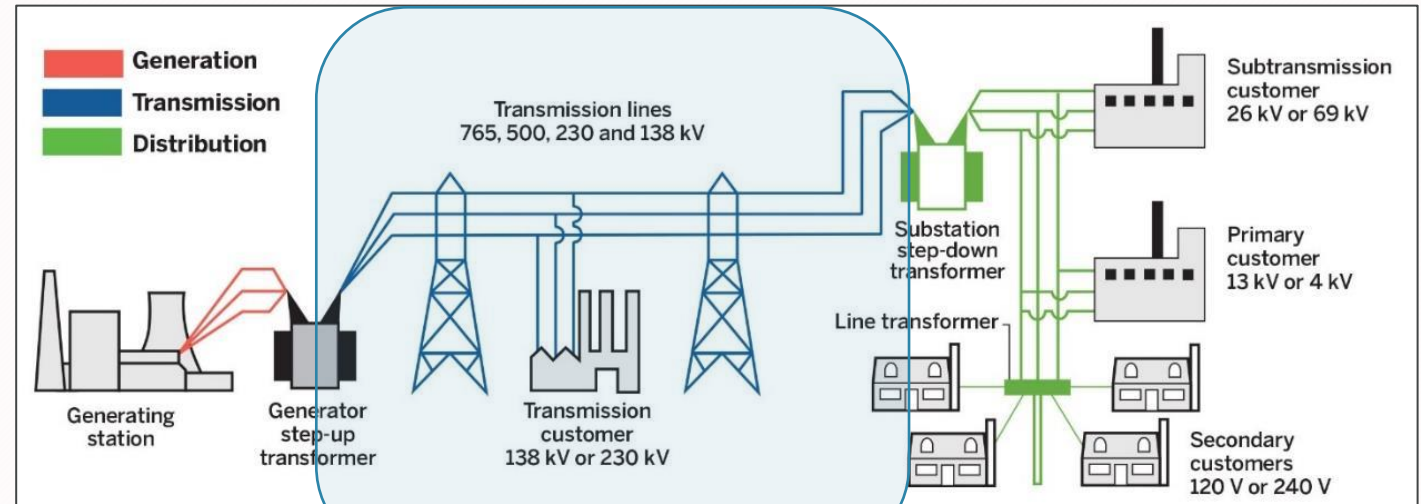


Overview of Electric Utility System

CFAES



RTO / PJM



Transmission

Transmission:

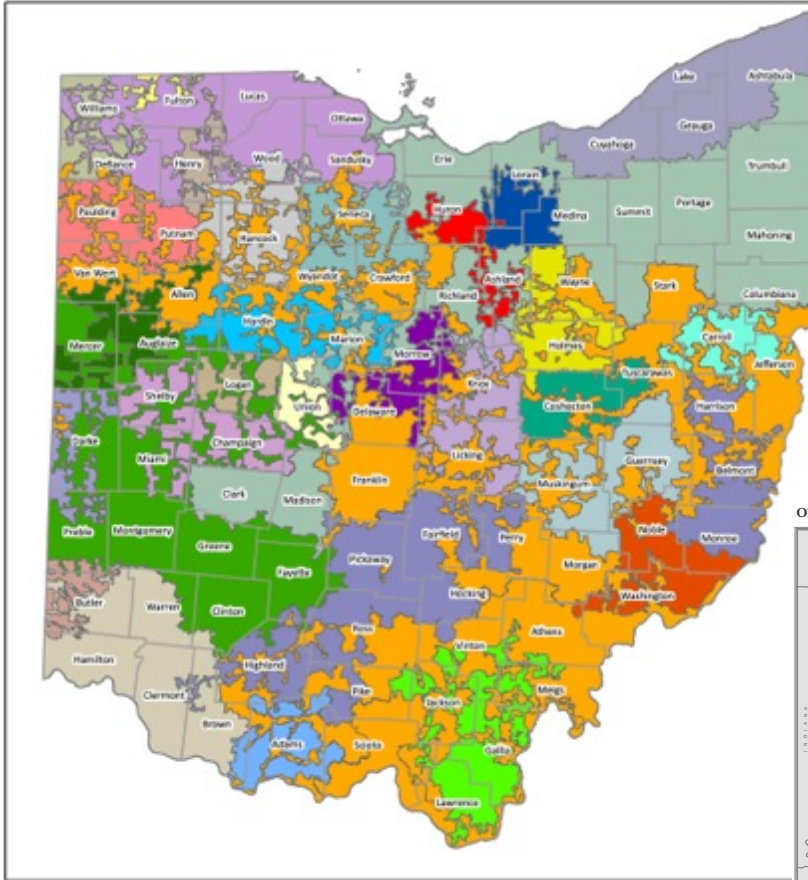
- Bulk transfer electricity
- Generator to substation
- Substation to substation
- Long distance
- High voltage (>69kV)

Overview of Electric Utility System

CFAES

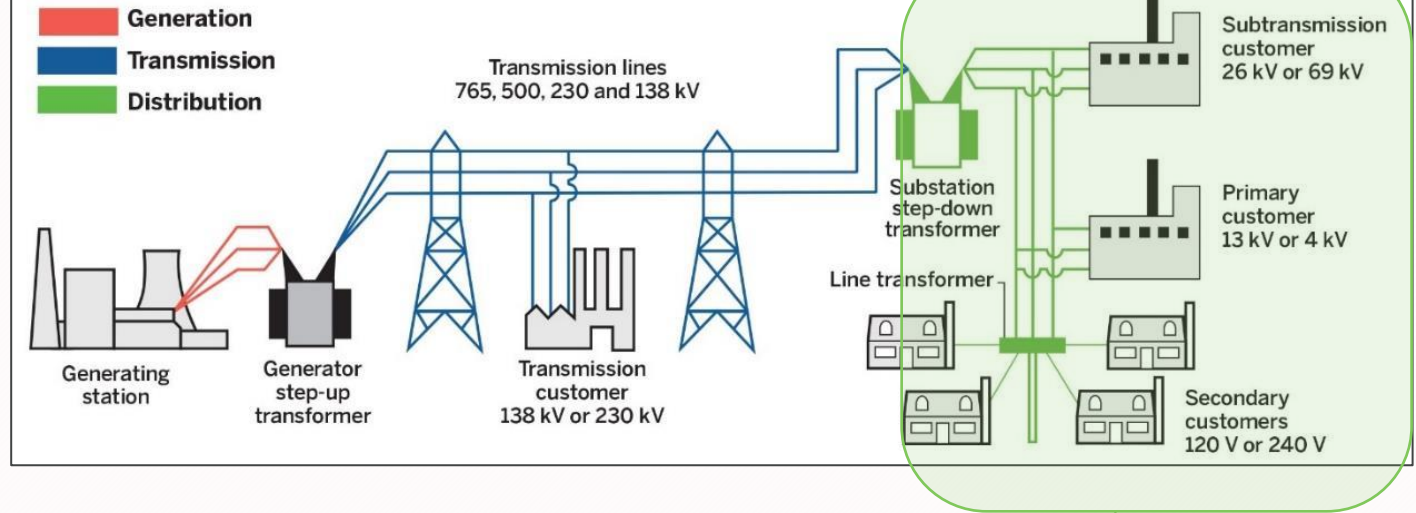
Ohio Public Utilities Commission

Ohio Electric Service Areas
As of 4/13/2022



Ohio Municipal Electric Utilities

Ohio Public Utilities Commission



PUCO

Distribution:

- Limited energy transferred
- Substation to customer
- Residential or business
- Short distance
- Low voltage (<69kV)

Distribution

OHIO STATE UNIVERSITY EXTENSION

Overview: Electric Utility System

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Supply

Generation

- Investor-Owned Utilities
- American Municipal Power
- Rural Electric Cooperatives
- CRES Providers (CRES)
- Self-Generator

Capacity

- Generation assets on standby to satisfy peak demands.
- PJM capacity auctions are held 3 years in advance.

Delivery

Transmission

- American Transmission System
- American Electric Power
- Dayton Power and Light
- Duke Energy Ohio Kentucky
- Ohio Valley Electric Corp.

Distribution

- Electric Distribution Utility - 5
- Rural Electric Cooperatives - 25
- American Municipal Power - 84

Demand

Residential

Commercial

Industrial

Transportation

Regulatory Oversight – Federal, State, or Local?

Public Utilities Commission of Ohio (PUCO)

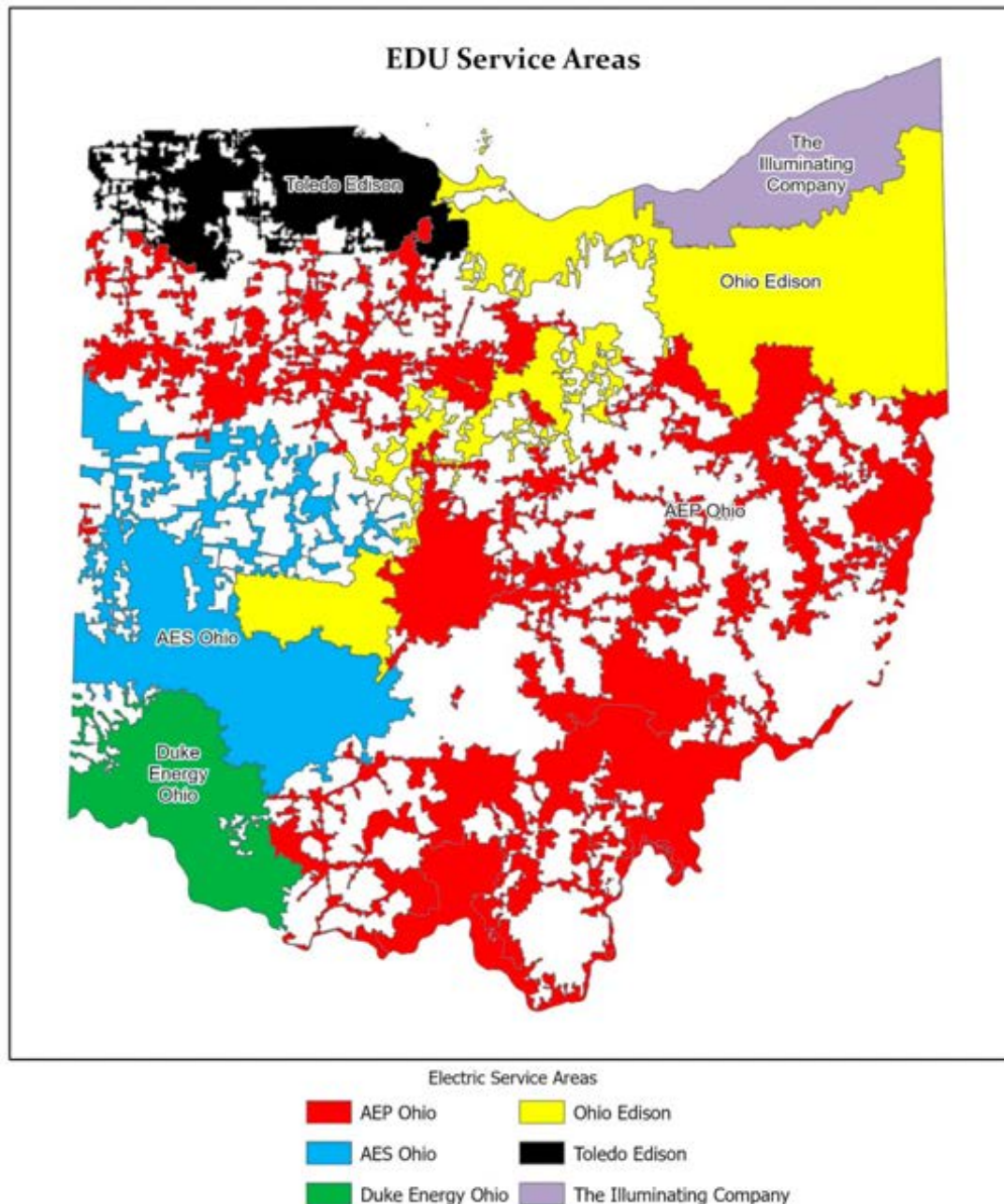
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History of the PUCO

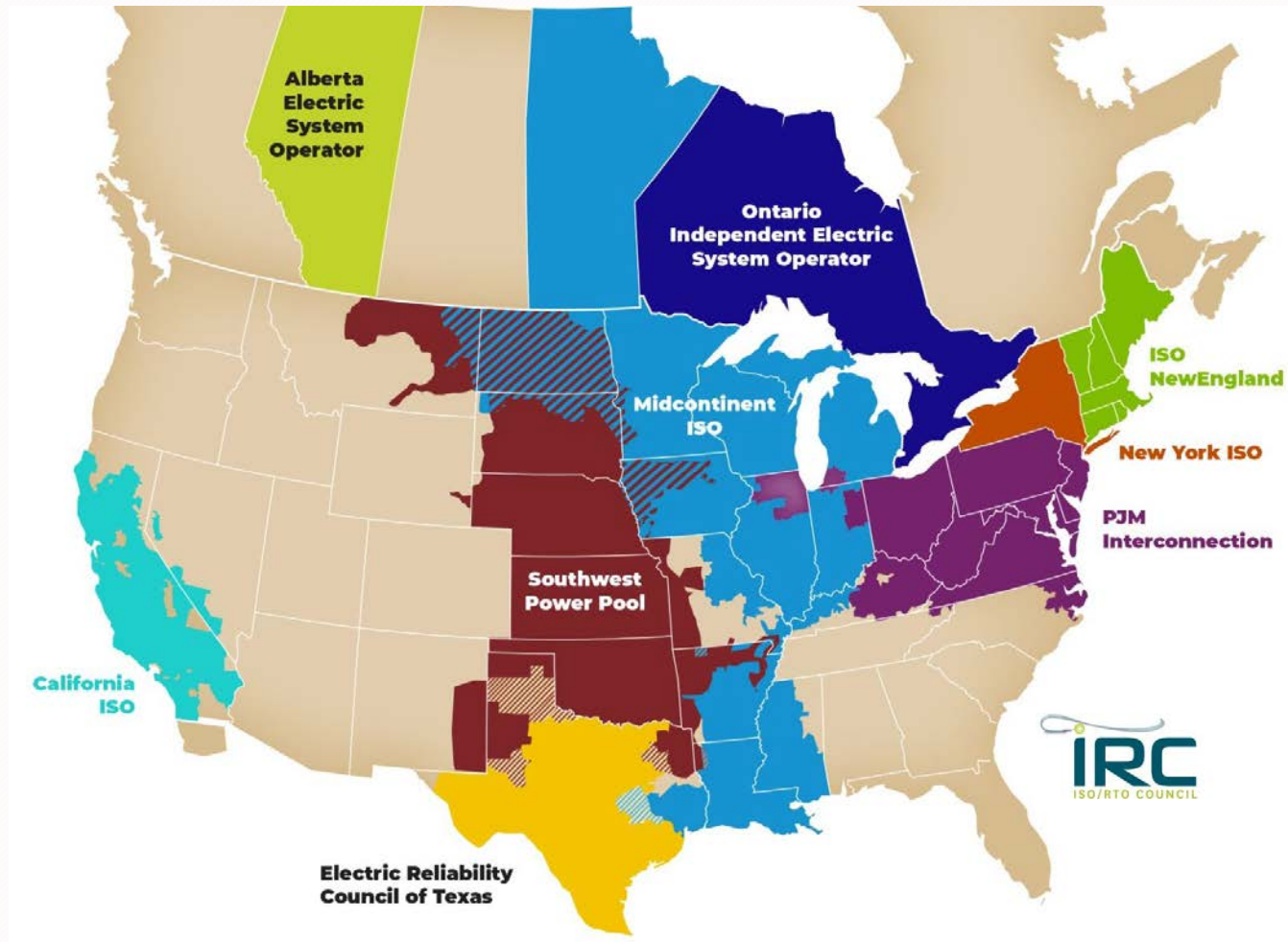
- **1867** - Utility and transportation regulation began in Ohio.
 - **1911** - Public Service Commission was established and authority expanded beyond railroads, to include electric, gas, telephone, and water companies.
 - **1913** - Name changed to the Public Utilities Commission of Ohio (PUCO).
 - **1921** - PUCO began regulating motor bus lines.
 - **1961** - PUCO began regulating wastewater companies.
- PUCO **regulates** providers of **all kinds of utility services**, including electric and natural gas companies, local and long-distance telephone companies, water and wastewater companies, rail and trucking companies.
 - **PUCO Mission** - To **assure** all residential and business consumers **access to adequate, safe, and reliable utility services at fair prices**, while facilitating an environment that provides competitive choices.

Electric Distribution Utility (EDU)

- PUCO regulates Electric Distribution Utilities (EDU), not co-ops or municipalities, as such this data only covers certain areas of the state.
- **Electric distribution utility** (EDU) - an electric distribution utility, which is an investor-owned electric utility that owns and operates a distribution wires system and supplies at least retail electric distribution service.



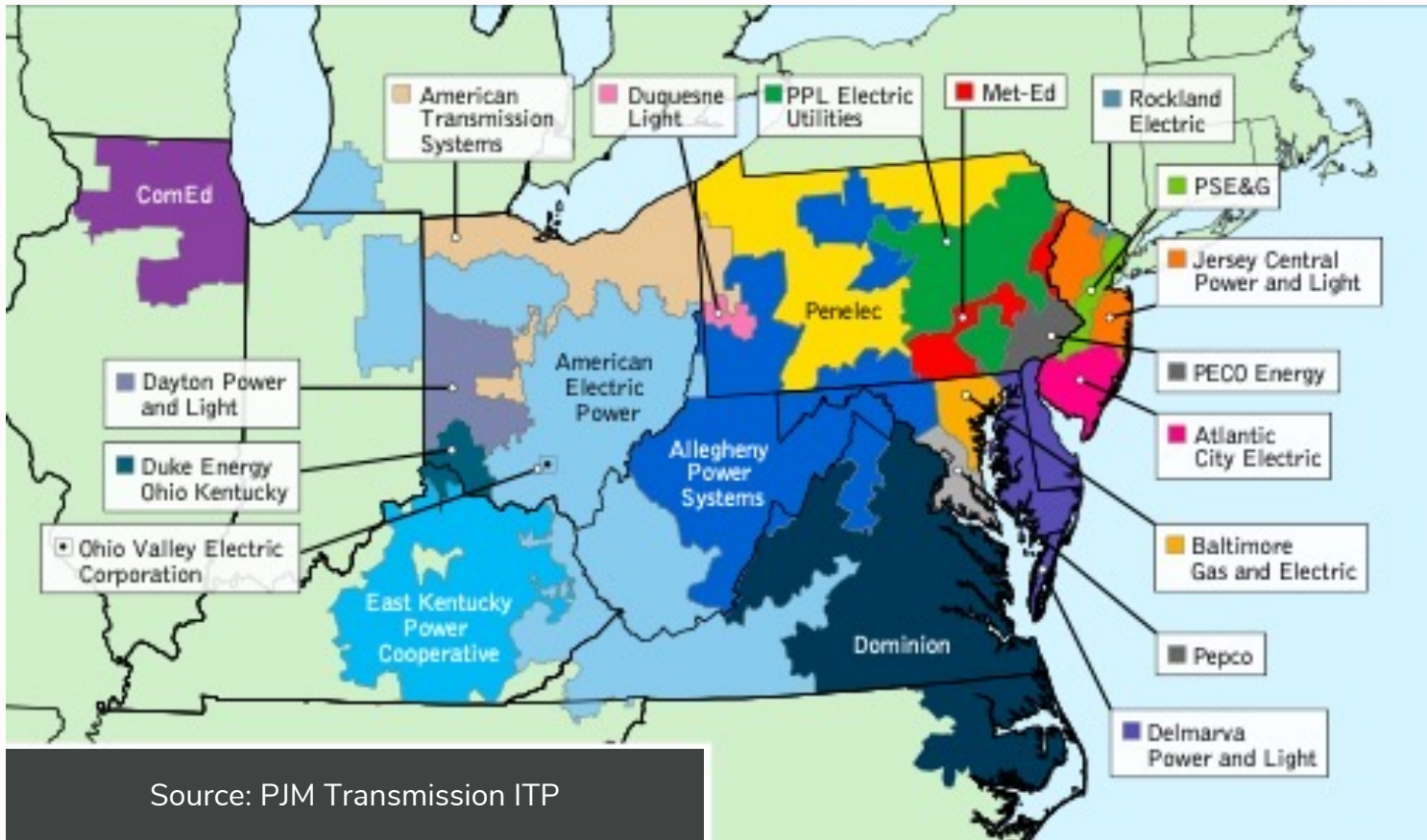
Regional Transmission Organizations (RTOs)



- RTOs are independent, membership-based, **non-profit** organizations.
- RTO's **authority** is from the Federal Energy Regulatory Commission.
- RTOs **do not own** generating plants or transmission lines.
- **Ensure reliability** and optimize supply & demand bids for wholesale electric.
- **Plan** and coordinate transmission additions and upgrades.

PJM

Interconnection

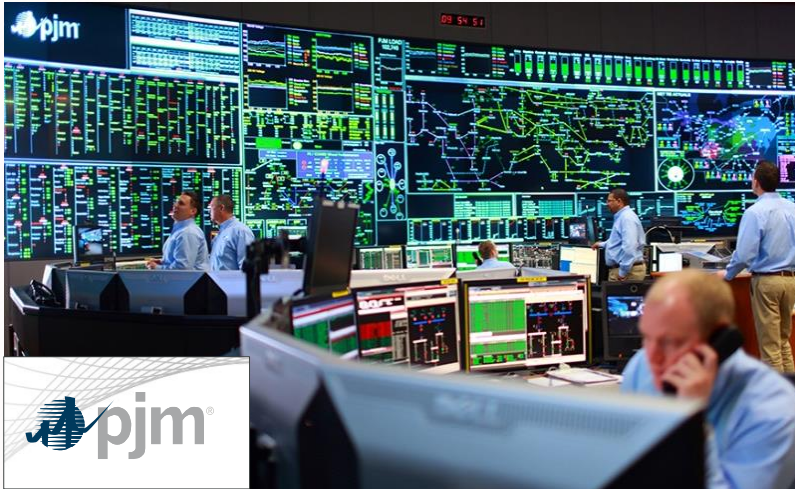


Key Statistics	PJM
People (Millions)	65
Transmission Line (Miles)	85,103
Generation Capacity (MW)	185,442
Area Served	13 States + D.C.

- Direct power companies to adjust generation to maintain electricity flow in delicate balance.
- Monitor high-voltage transmission systems for possible overload.
- Maintain system security.
- Use forecasts to plan for weather events.

Inside the PJM Control Room

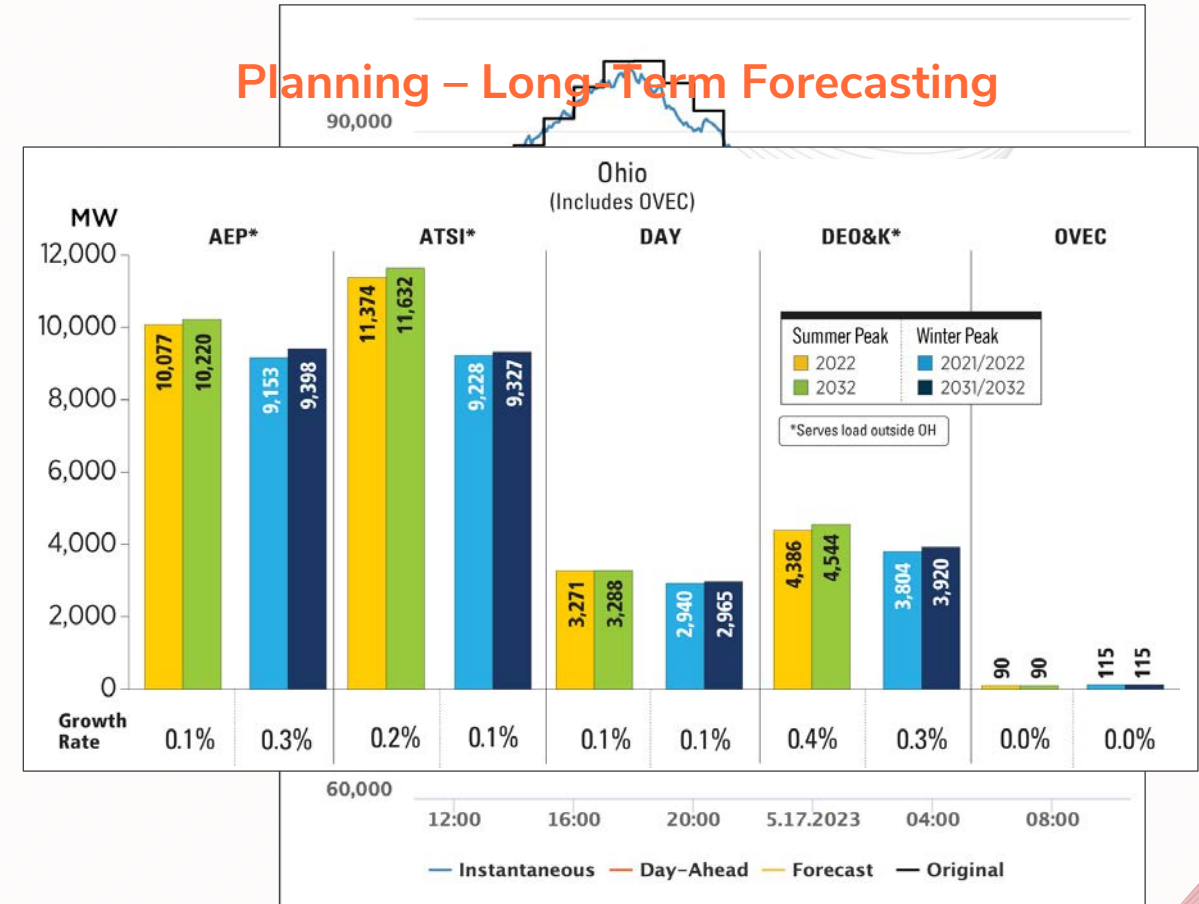
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- Managing the future needs of the electric system is an integral part of PJM's role. PJM conducts a long-range Regional Transmission Expansion Planning process that identifies what changes and additions to the grid are needed to ensure reliability and the successful operation of the wholesale markets.

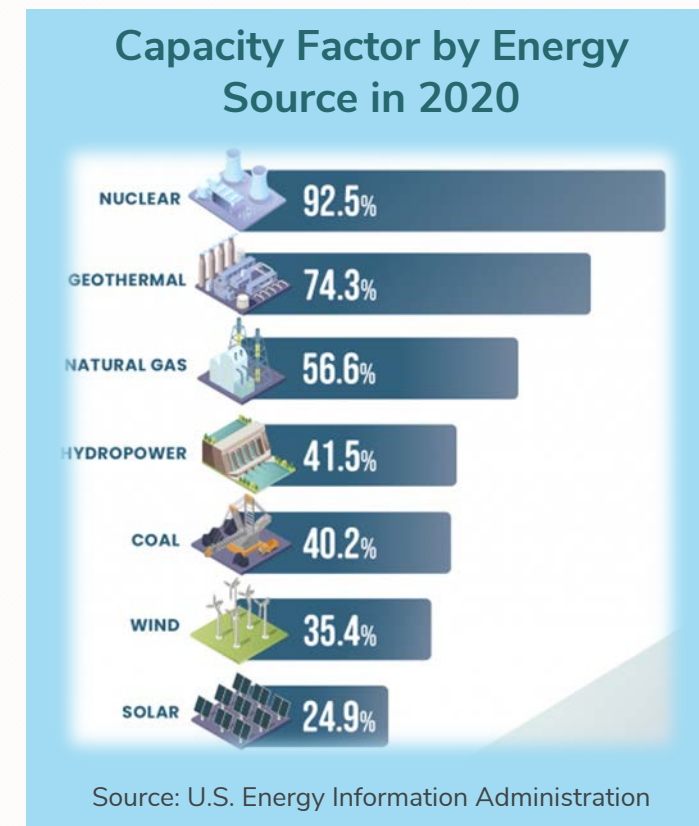
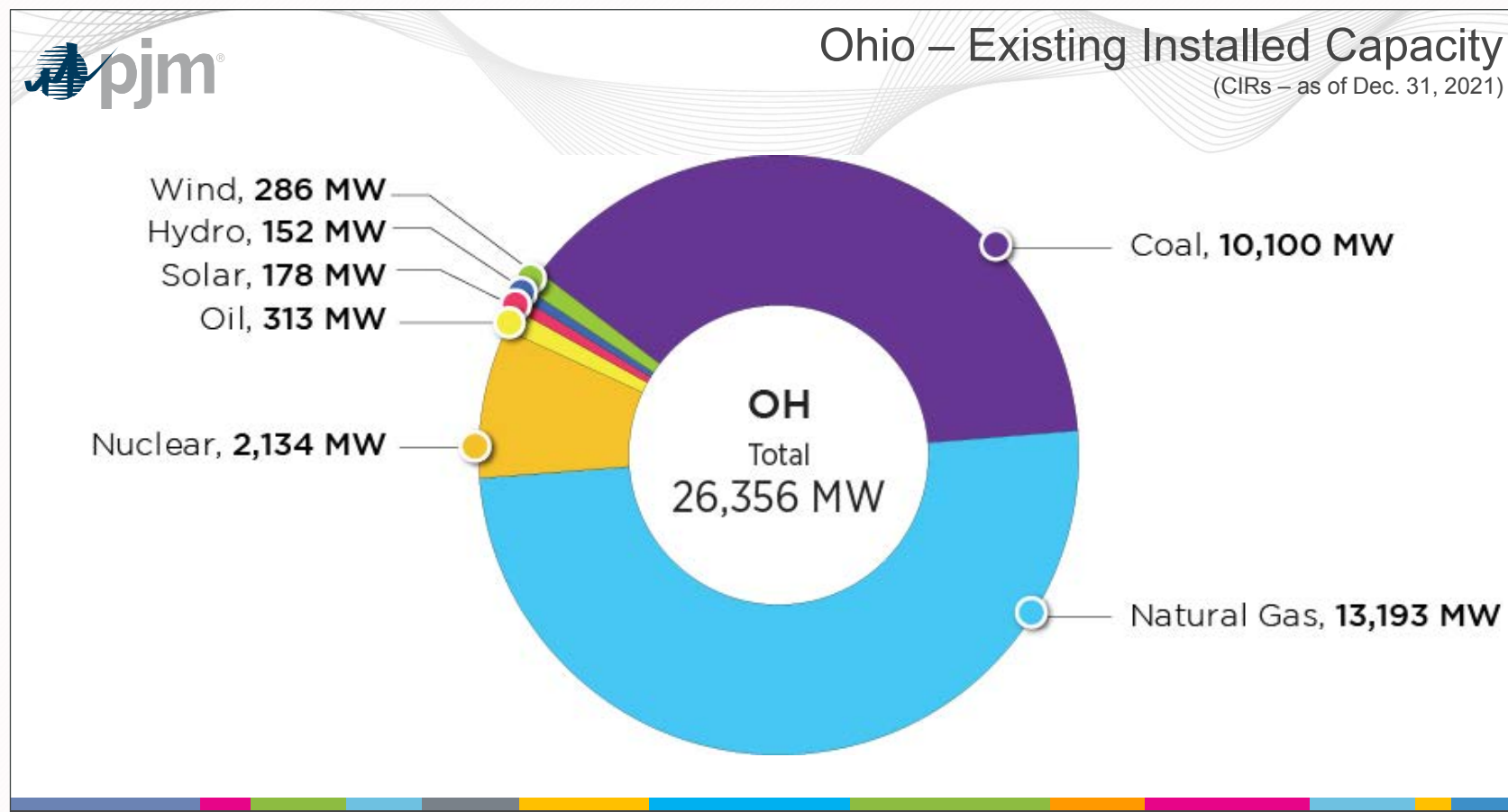
Planning – Daily Load Forecast

Planning – Long Term Forecasting



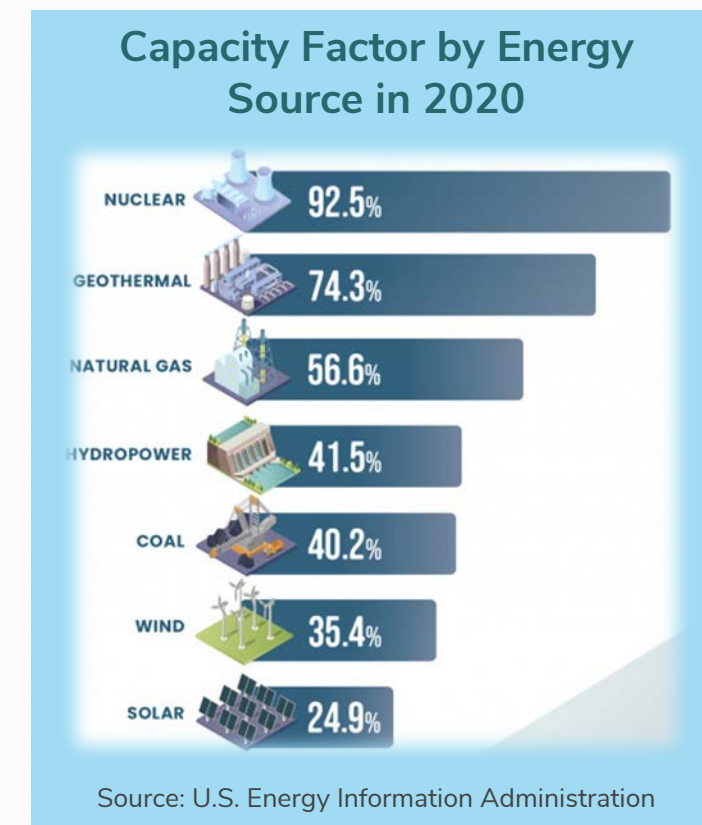
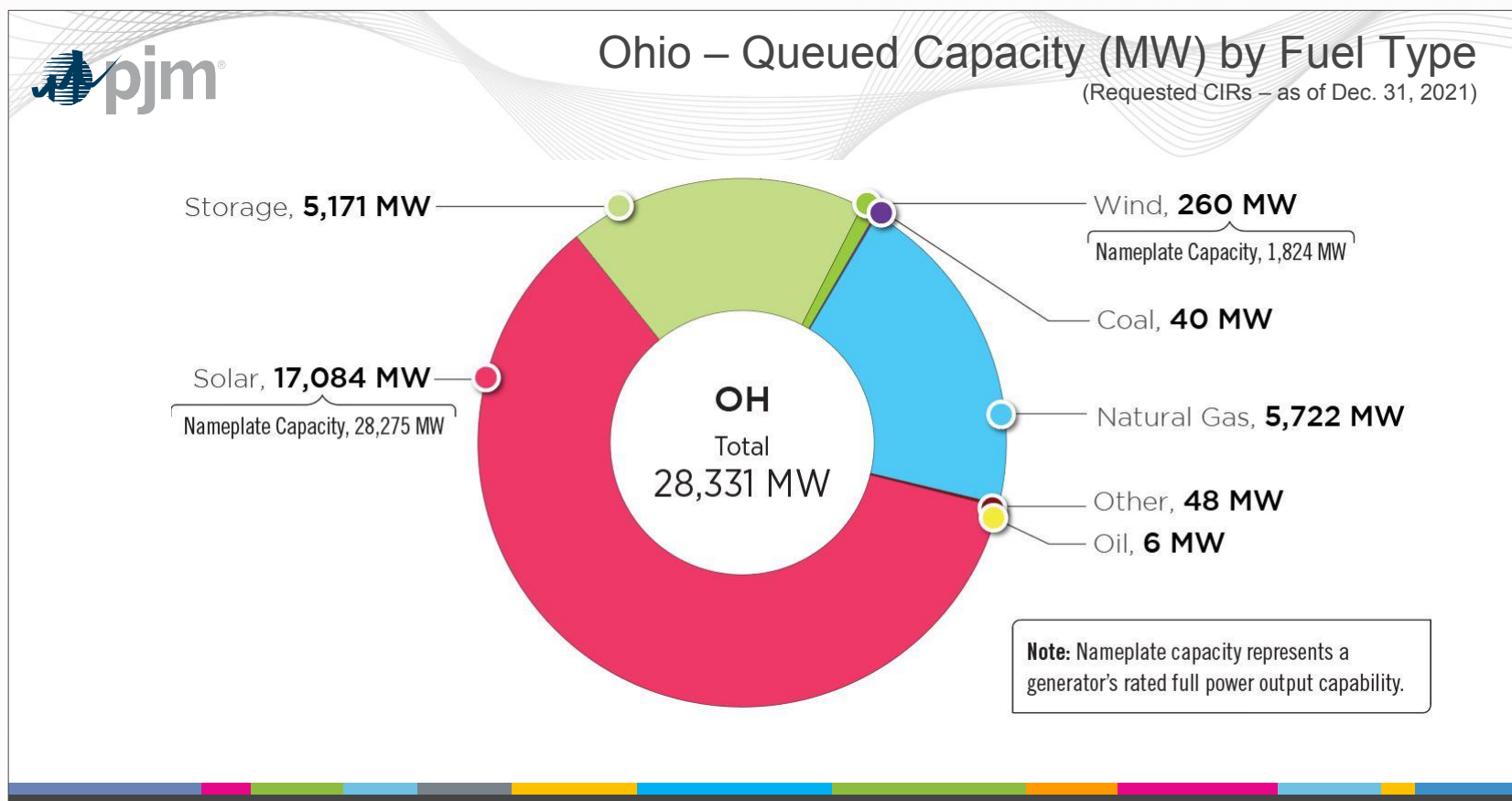
Ohio – Installed Capacity (**Operational**)

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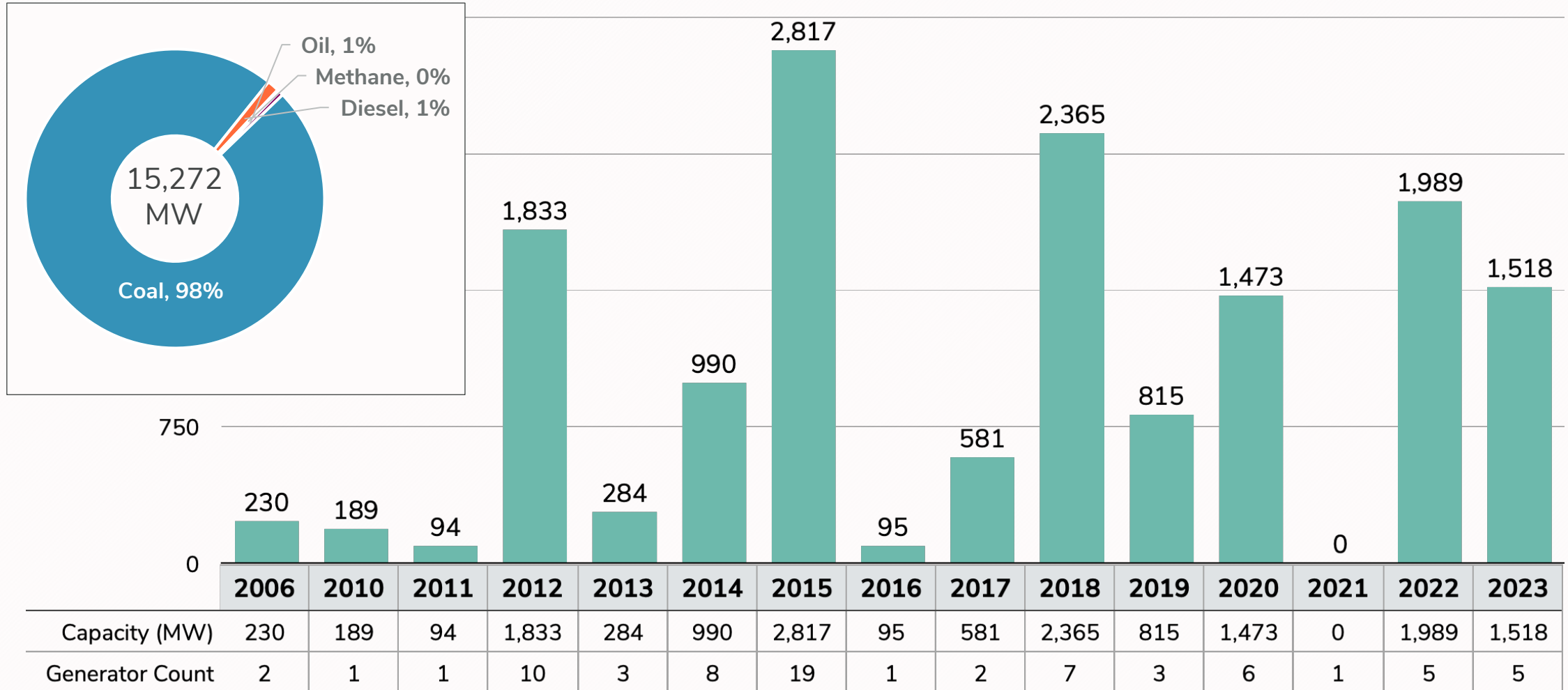
Ohio – Queued Capacity (**Planned**)

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PJM - Ohio Electric Generation Retirements

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Interconnection to the Distribution Grid





Interconnection to Distribution Grid
**Public Utilities Commission
of Ohio (PUCO)**



Ohio Electric Distribution Utility (EDU)

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The interconnection process in Ohio **begins by contacting your local utility**. A Point of contact for each Ohio electric distribution utility (EDU) are listed below:

AEP Ohio

Phone: (614) 883-6775

Email: dgcoordinator-ohio@aep.com

Website: Installing Generating Equipment

AES Ohio

Phone: (937) 331-4554

Email: interconnection@aes.com

Website: Renewable Energy Process

Duke Energy Ohio

Phone: (866) 233-2290

Email: customerownedgeneration@duke-energy.com

Website: Generate Your Own Renewable Energy

FirstEnergy Companies

Website: Ohio Interconnection

Toledo Edison

Fax: (330) 245-5296

Email: TE_interconnection@firstenergycorp.com

Ohio Edison

Fax: (330) 245-5419

Email: OE_interconnection@firstenergycorp.com

The Cleveland Electric Illuminating Company

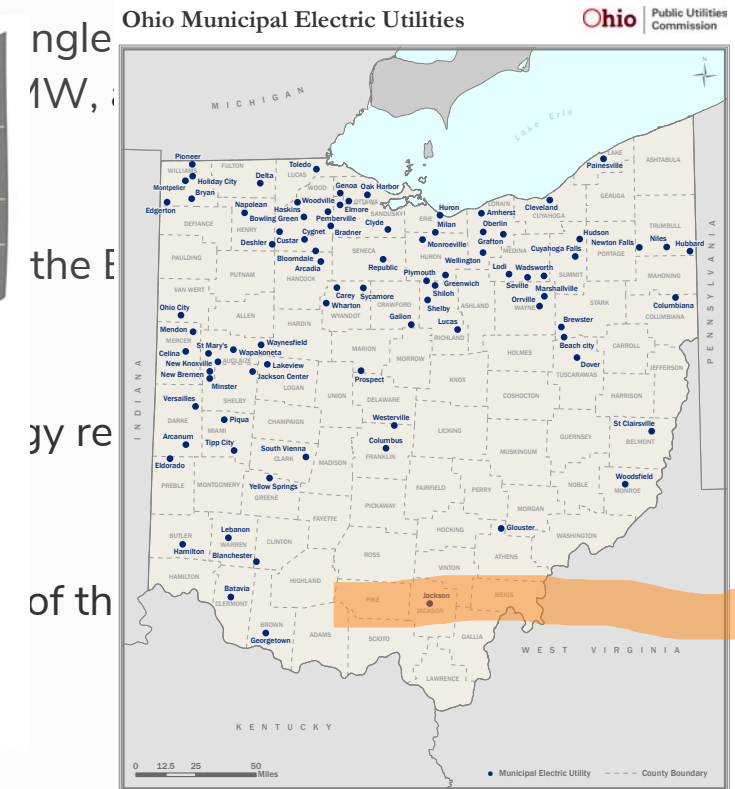
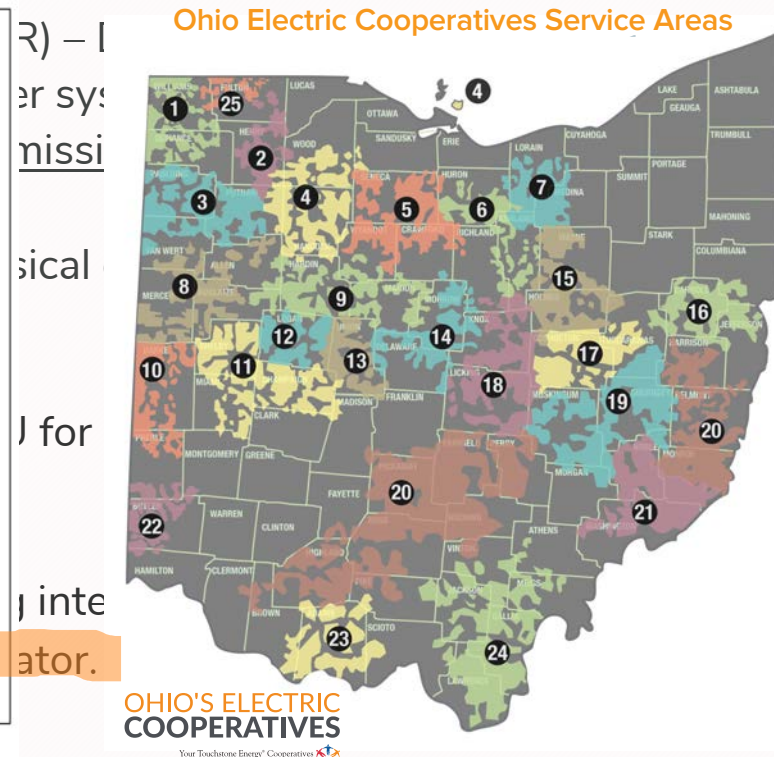
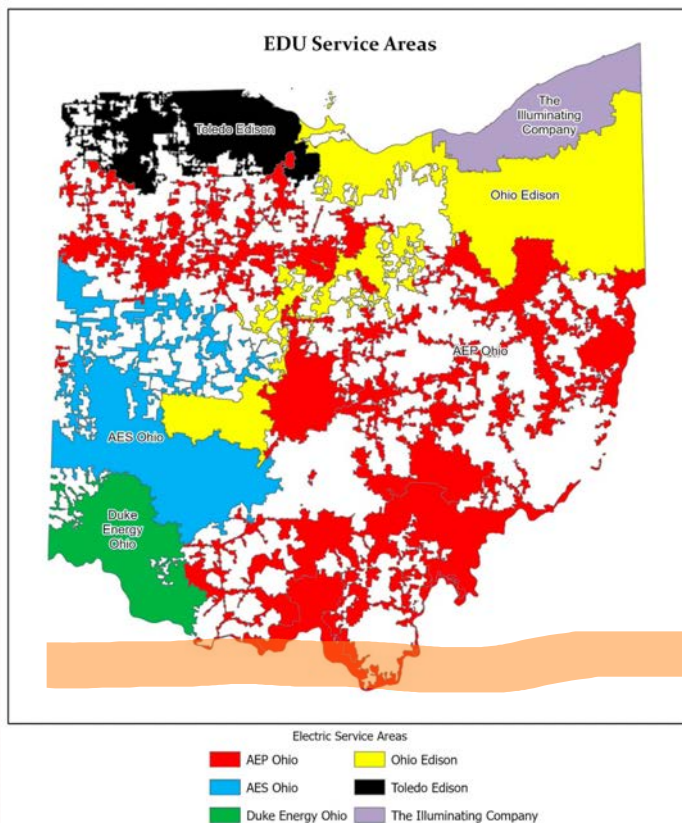
Fax: (330) 436-8255

Email: CEI_interconnection@firstenergycorp.com

PUCO Interconnection: Key Definitions

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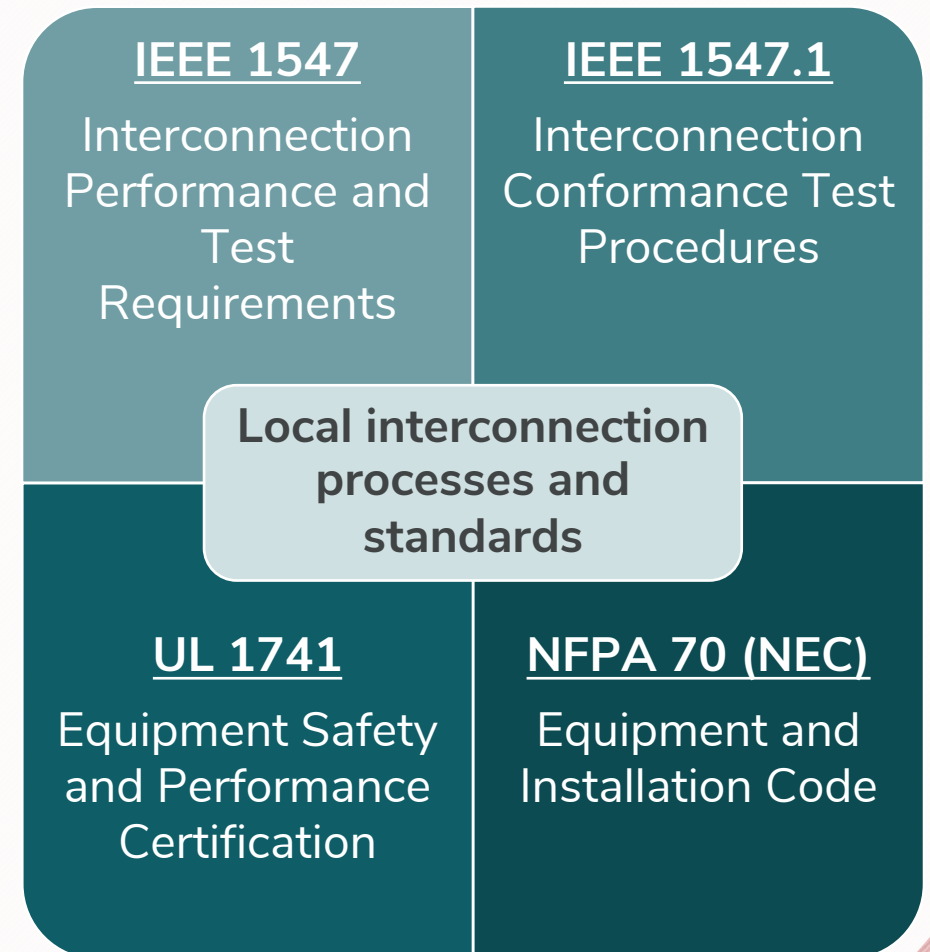
- **Electric distribution utility (EDU)** - an electric distribution utility, which is an investor-owned electric utility that owns and operates a distribution wires system and supplies at least retail electric distribution service.



PUCO Interconnection: Safety and Performance Standards

The PUCO Ohio Administrative Rule 4901:1-22-03
requires safety and performance standards
established by the.....

- Institute of Electrical & Electronics Engineers (IEEE)
- Underwriters Laboratory (UL)
- National Fire Protection Association/National Electric Code (NEC)



Institute of Electrical & Electronics Engineers (IEEE) Standards

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- Due to the increase of distributed energy resources and **two-way power flow in the electric grid**, the IEEE 1547-2018 technical standards help align evolving requirements of the local distribution grid and the bulk power transmission.
- Outline minimum technical standards for **safe and reliable interconnection and data communication** of electric DERs to the distribution grid.



OAC Rule 4901:1-22-03
Industry Standards

Key technical considerations include mandatory voltage and frequency trip settings, ride-through capability, controls configuration, and communication interface considerations.

PUCO Interconnection: Level 1

Eligibility:

- The applicant's proposed DER's point of common coupling is not on a transmission line.
- The DER has a nominal nameplate capacity of **twenty-five kilowatts or less**.
- The DER uses inverter-based equipment that is certified in compliance with the IEEE and UL standards set forth in rule 4901:1-22-03 of the Administrative Code.

Timeline:

- Within 15 business days of the EDU notifying the applicant that it has received an application.

Fee:

- level 1 fee shall not exceed \$50 and may be waived by the EDU.



PUCO Interconnection: Level 2

Eligibility:

- System is ineligible for Level 1 Review.
 - The applicant's proposed DER's point of common coupling is not on a transmission line.
 - The DER has a nominal nameplate capacity **between 25 kW and 5 MW**
 - The DER uses inverter-based equipment that is certified in compliance with the IEEE and UL standards set forth in rule 4901:1-22-03 of the Administrative Code.
 - **Supplemental Review** - Systems under Level 2 review that failed the screening criteria but could possibly be interconnected safely and reliably after minor modifications/further study can submit for a Level 2 Supplemental Review.
- **Timeline** - within 20 business days of the EDU notifying the applicant that it has received an application.
 - **Fee** - Level 2 fee up to \$50, plus one dollar per kilowatt of system nominal nameplate capacity.

PUCO Interconnection: Level 3

Eligibility:

- System is ineligible for Level 1 or 2 Review.
- The applicant's proposed DER's point of common coupling is not on a transmission line.
- Systems \leq 20 MW.
- Systems using equipment not certified in compliance with IEEE 1547 and UL 1741 (non- inverter-based systems).
- **Interconnection study requirements** - One or more interconnection studies may be required by the EDU prior to interconnection of a level 3 DER including a feasibility study, a system impact study, and a facilities study.

Timeline: Varies.

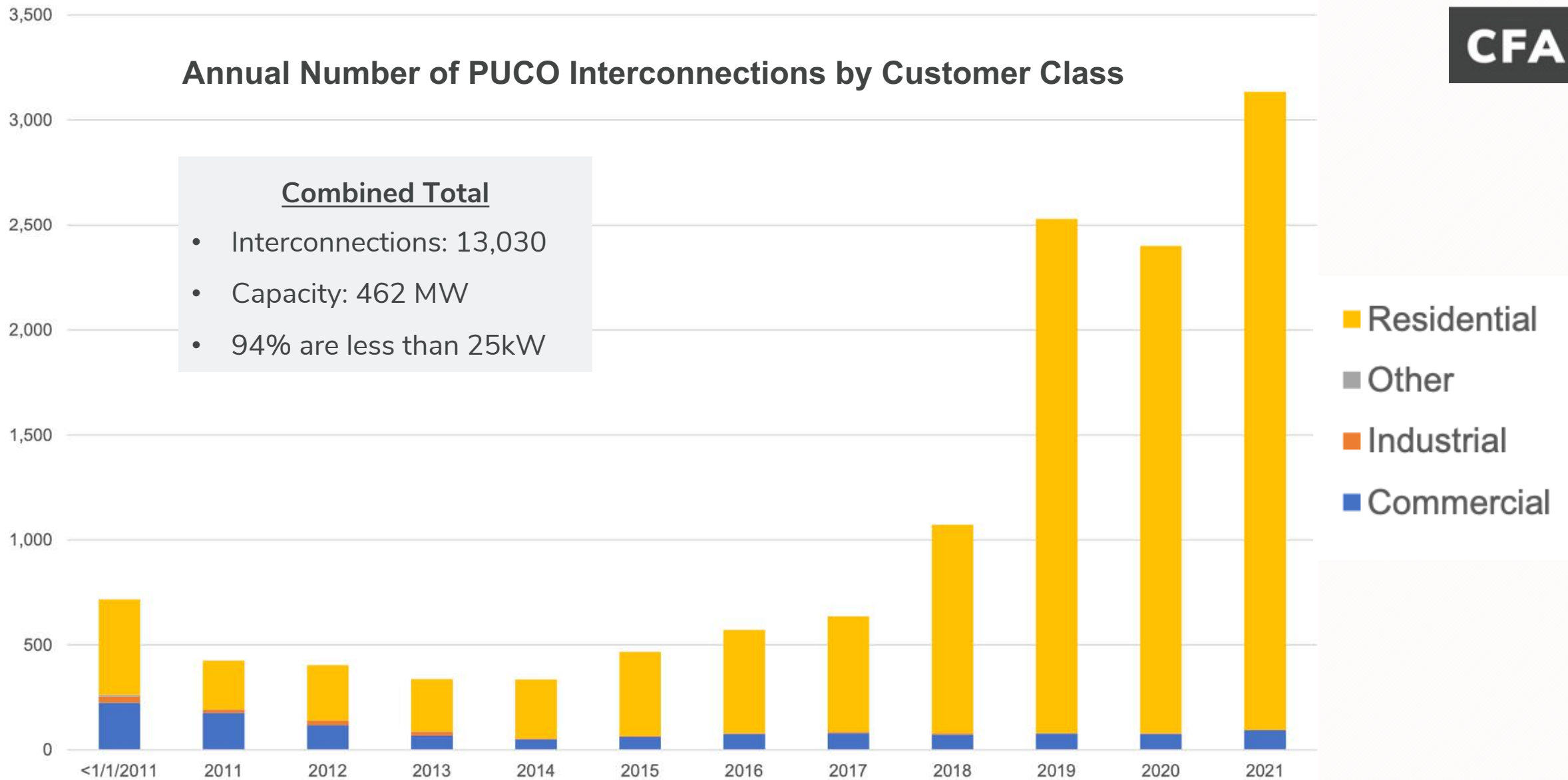
Fee: level 3 fee shall be up to \$100, plus two dollars per kilowatt of system nominal nameplate capacity, + cost of engineering work done, + actual cost of any minor modifications required of the EDU's system.



Annual Number of PUCO Interconnections by Customer Class

Combined Total

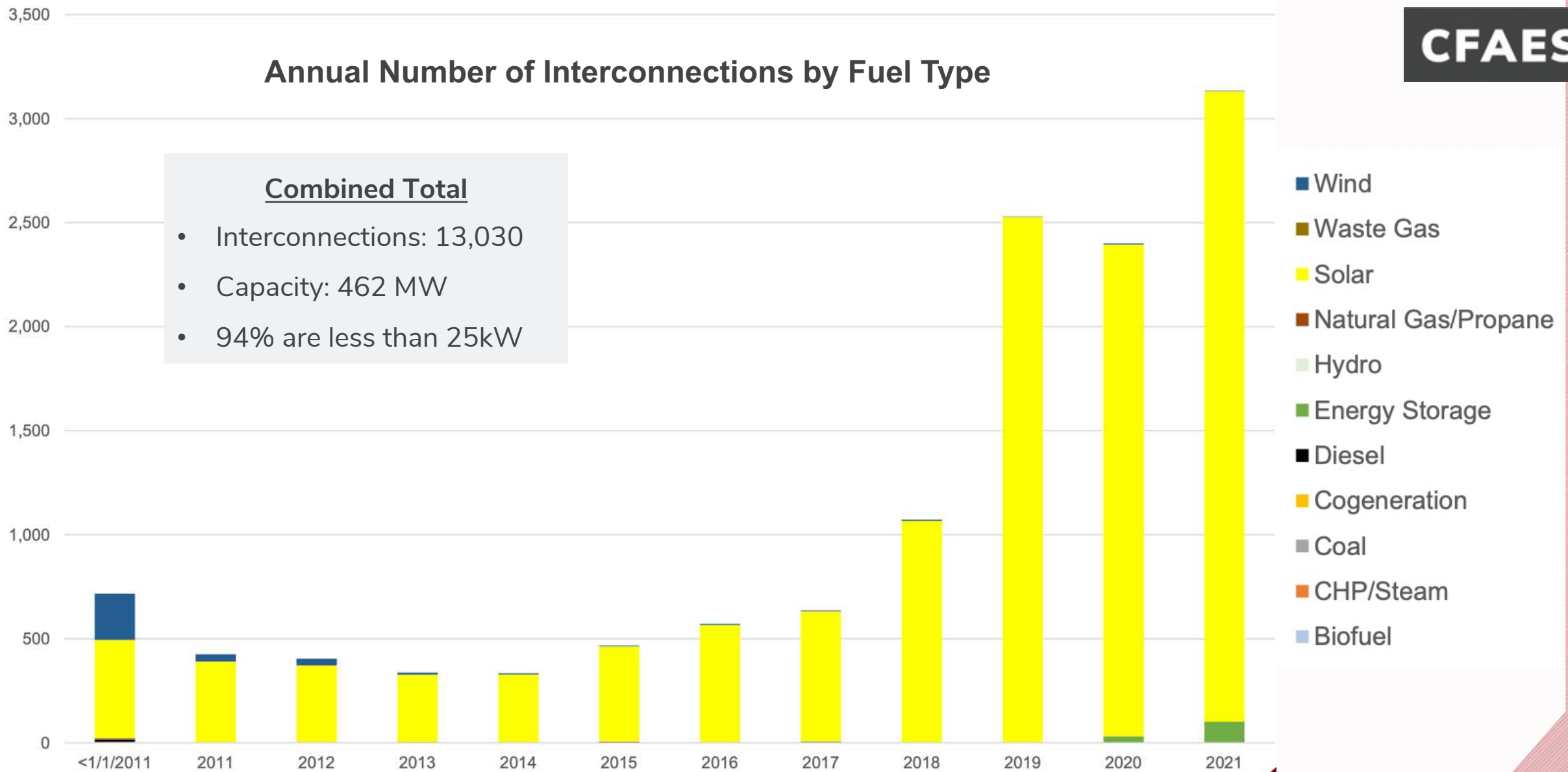
- Interconnections: 13,030
- Capacity: 462 MW
- 94% are less than 25kW



Annual Number of Interconnections by Fuel Type

Combined Total

- Interconnections: 13,030
- Capacity: 462 MW
- 94% are less than 25kW



Interconnection to the Transmission Grid



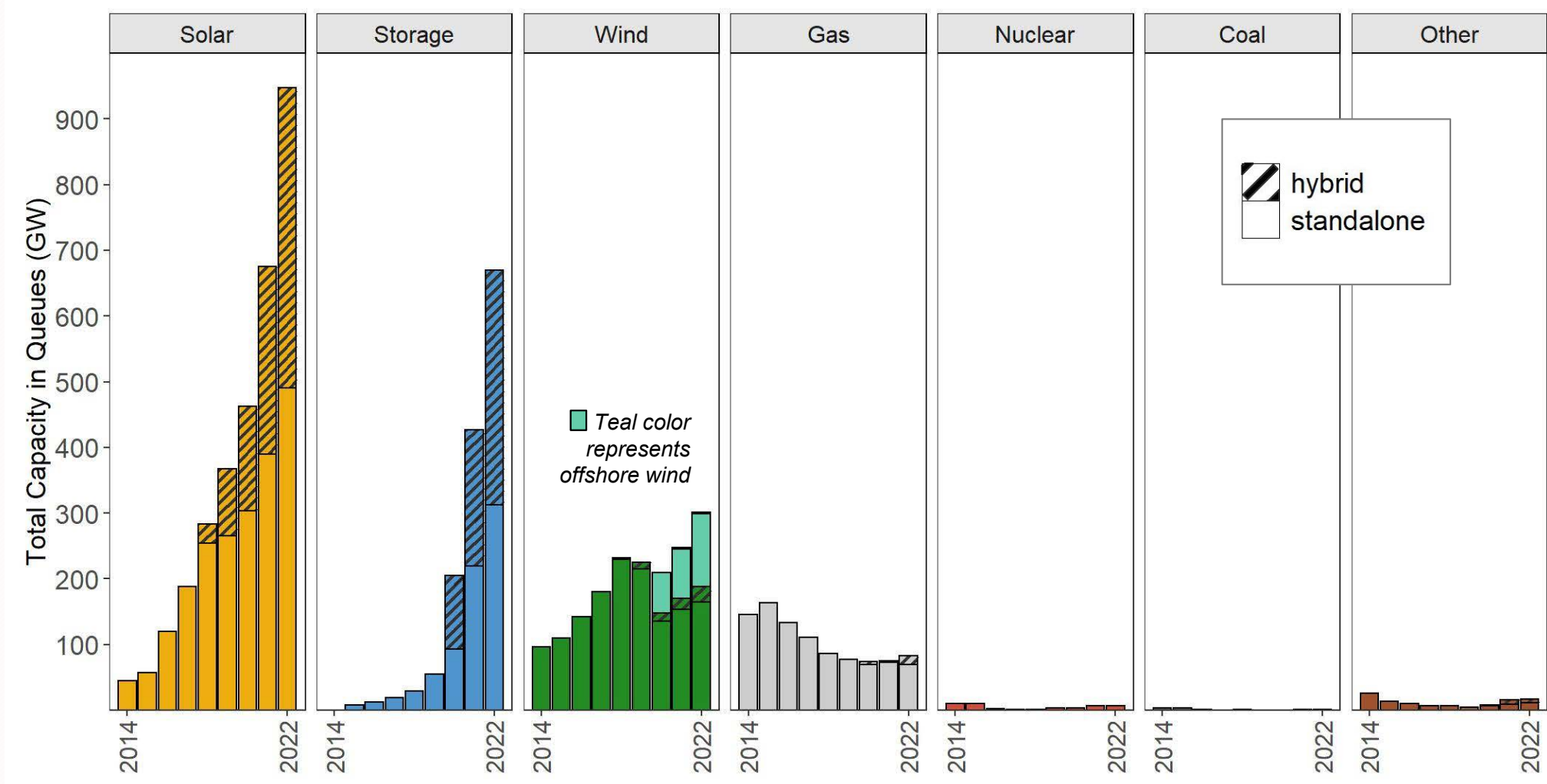


Interconnection to Transmission Grid

FERC / RTO/ PJM

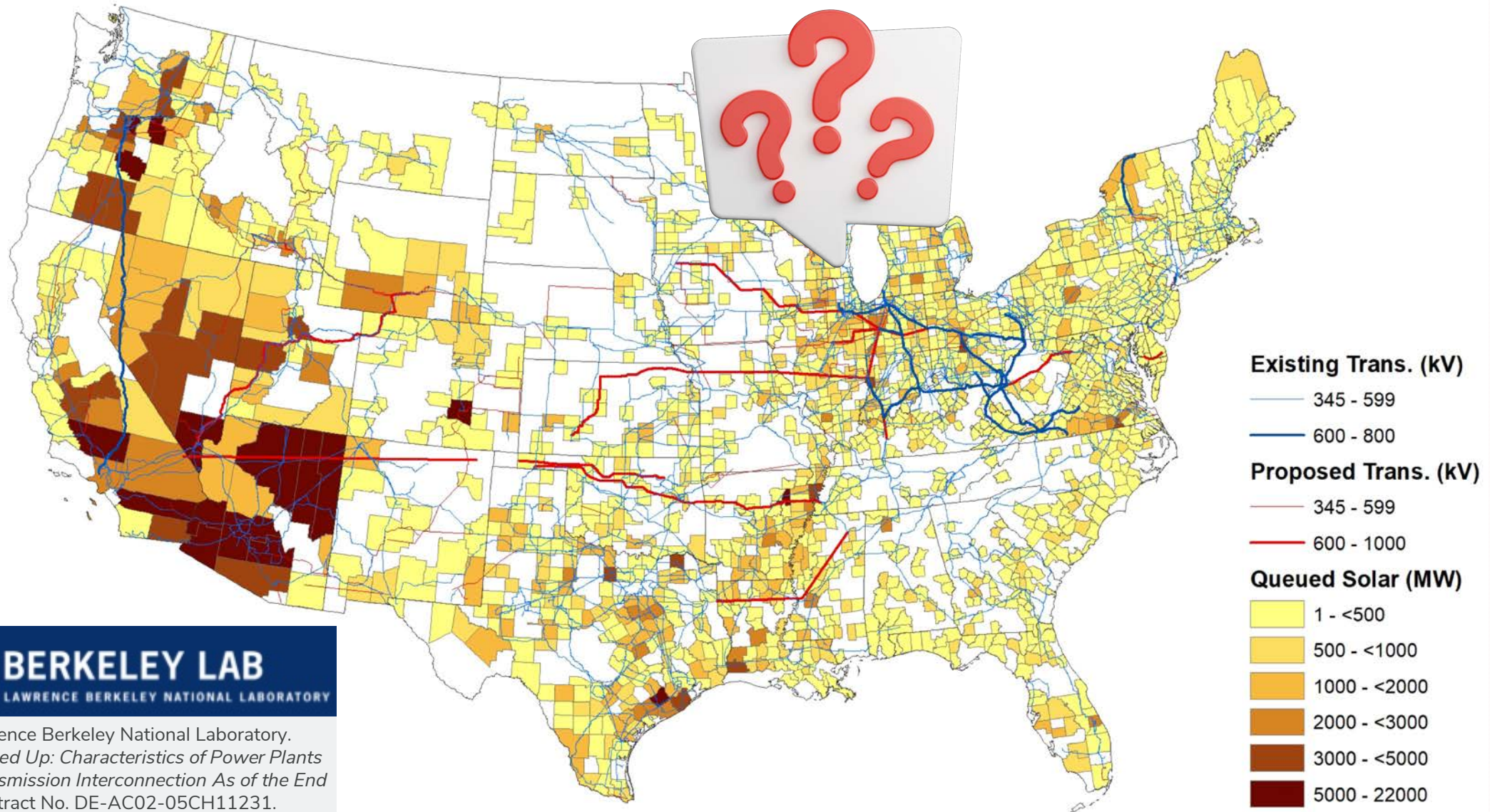


Active U.S. Capacity Interconnection Queues: by Source



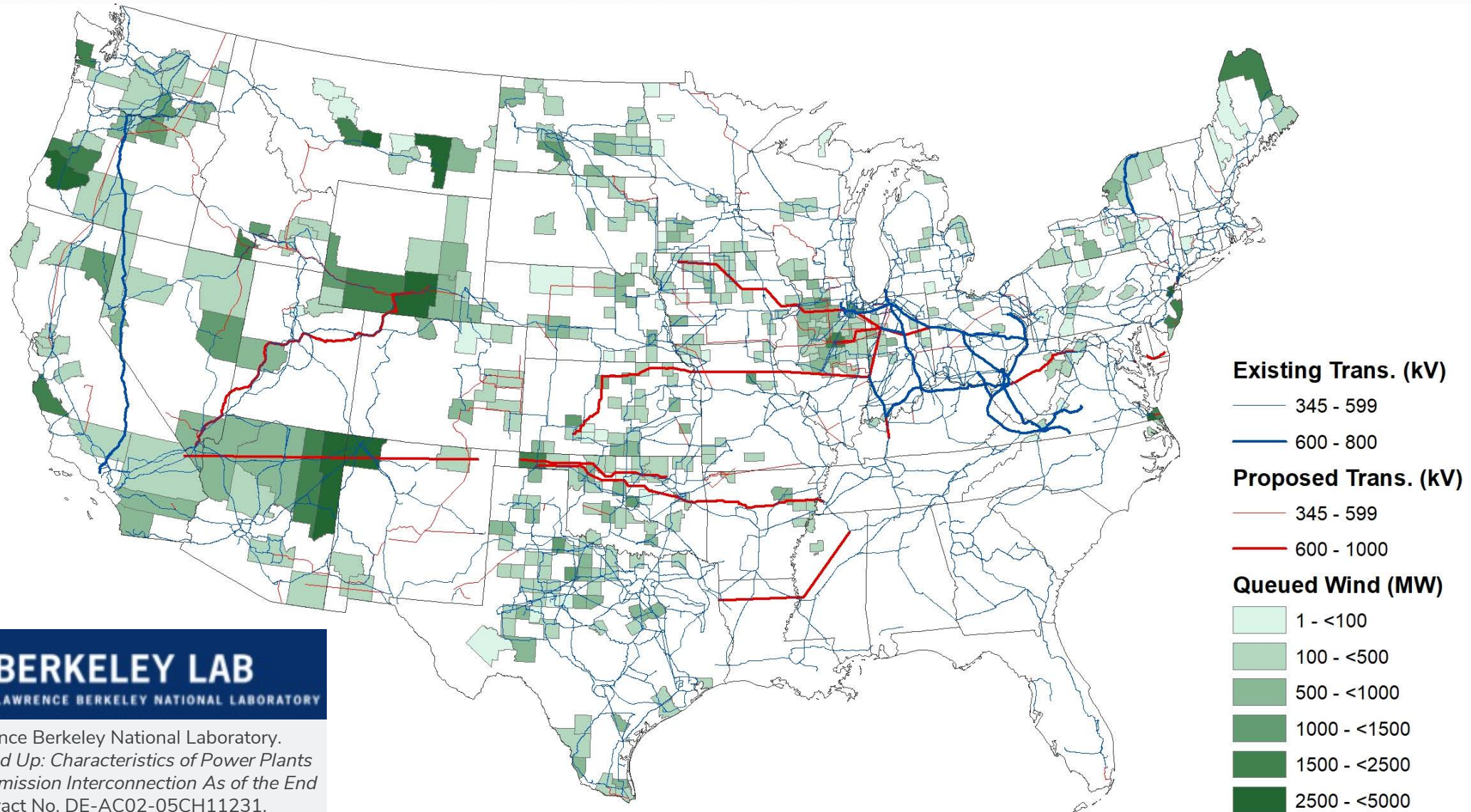
Active Solar Capacity in Queues: by County

CFAES

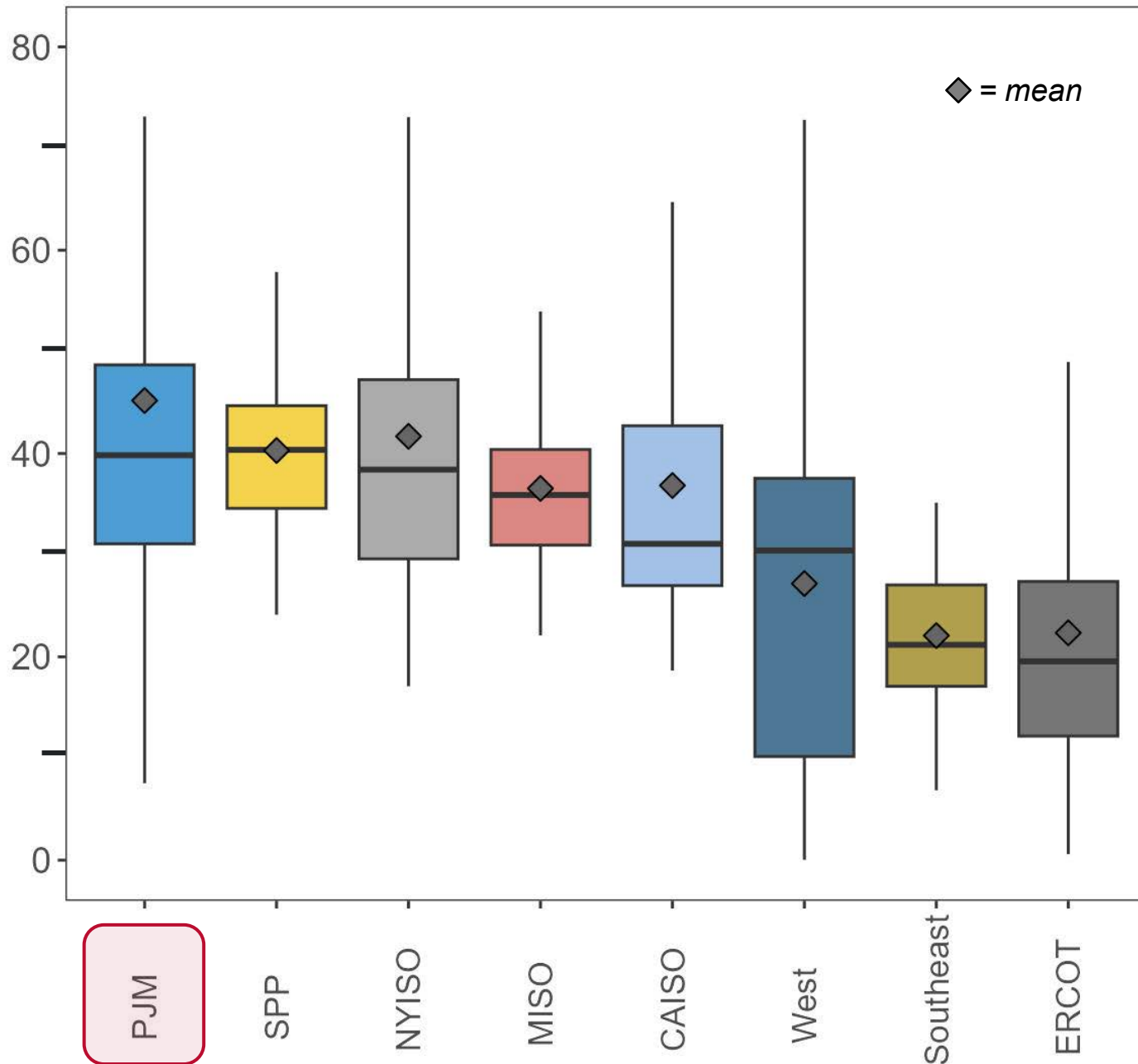


Active Wind Capacity in Queues: by County

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Time between submitting an Interconnection Request and executing an Interconnection Agreement (Months)



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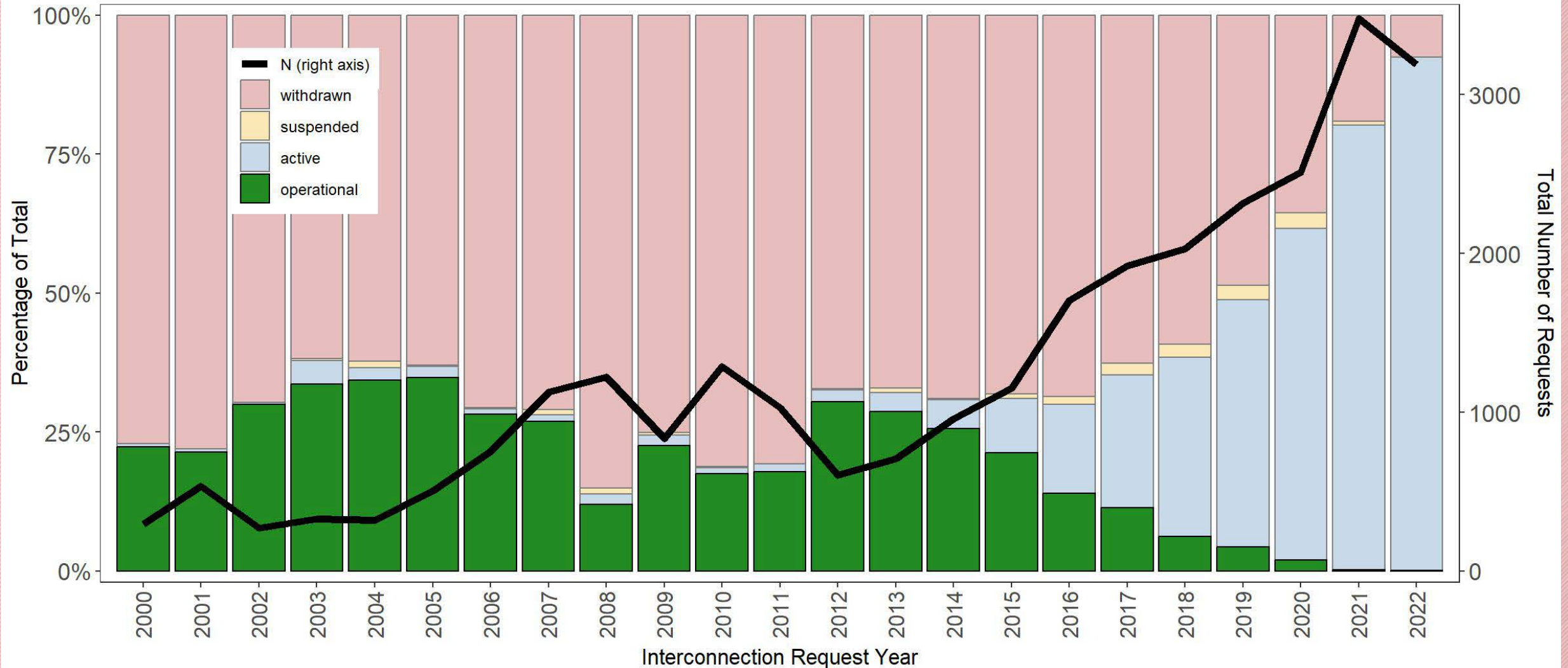
Study Duration of Interconnection Agreements Executed Between 2018 to 2022 by RTO



Source: Lawrence Berkeley National Laboratory. (2023). *Queued Up: Characteristics of Power Plants Seeking Transmission Interconnection As of the End of 2022*. Contract No. DE-AC02-05CH11231.

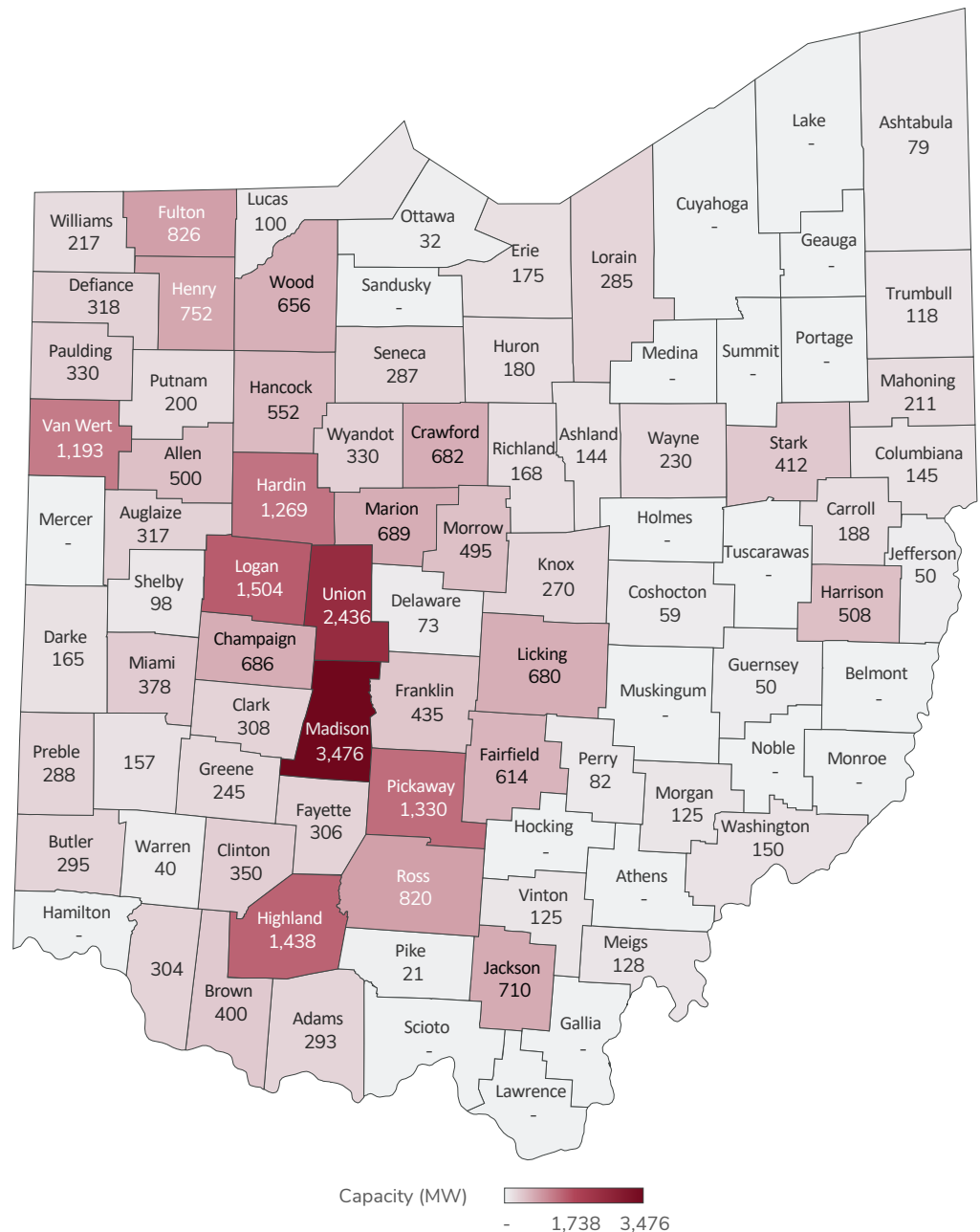
U.S. Interconnection Queue Projects Status (2000-2017)

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PJM Interconnection

Queue: Capacity (MW)



Top 10 Counties by Capacity

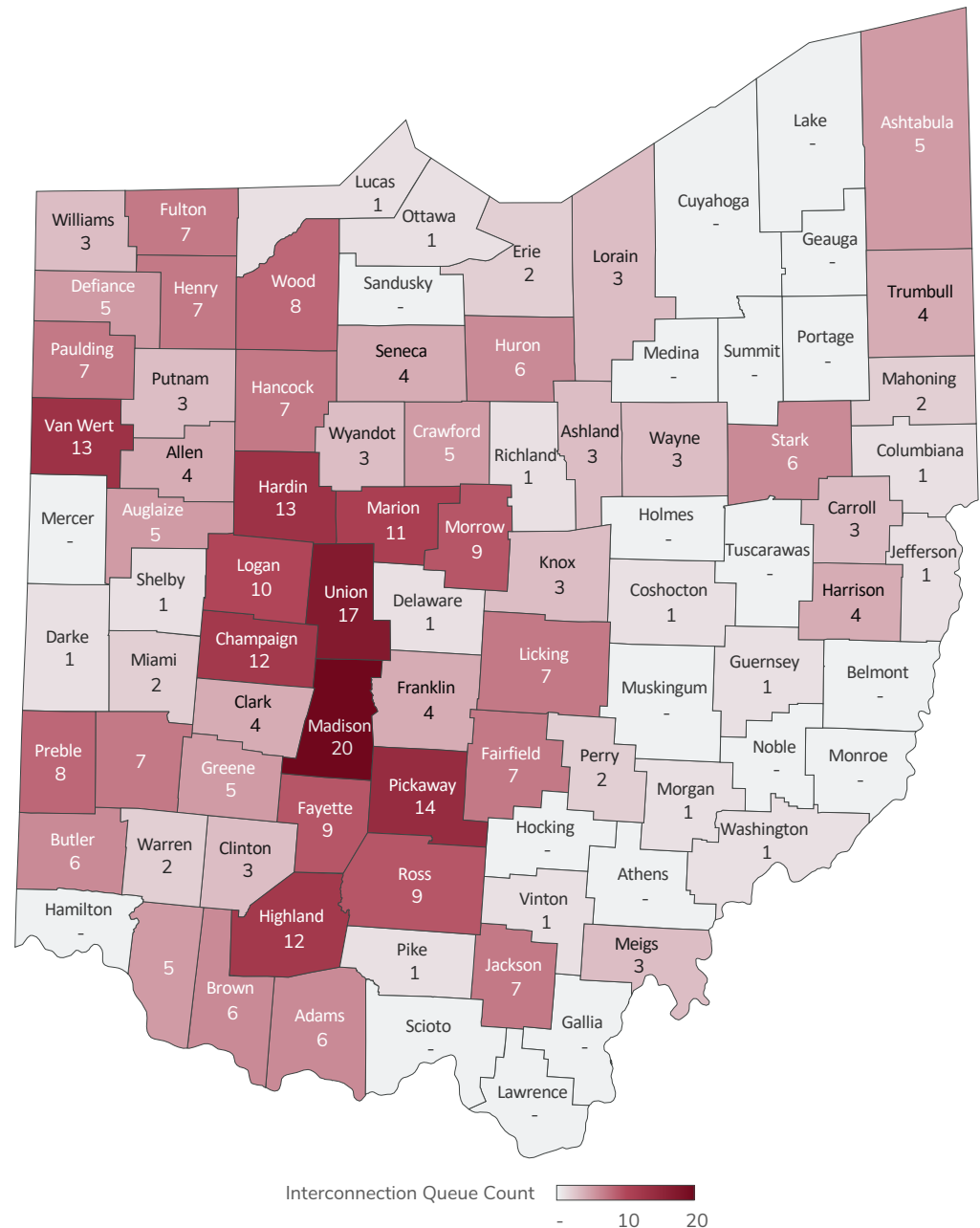
1. Madison - 3,476
2. Union - 2,436
3. Logan - 1,504
4. Highland - 1,438
5. Pickaway - 1,330
6. Hardin - 1,269
7. Van Wert - 1,193
8. Fulton - 826
9. Ross - 820
10. Henry - 752

**PJM Queue
Capacity Total:
29,719 (MW)**

Source: PJM -
<https://pjm.com/planning/services-requests.aspx>

PJM Interconnection

Queue: Project Count



Top 10 Counties by Project Count

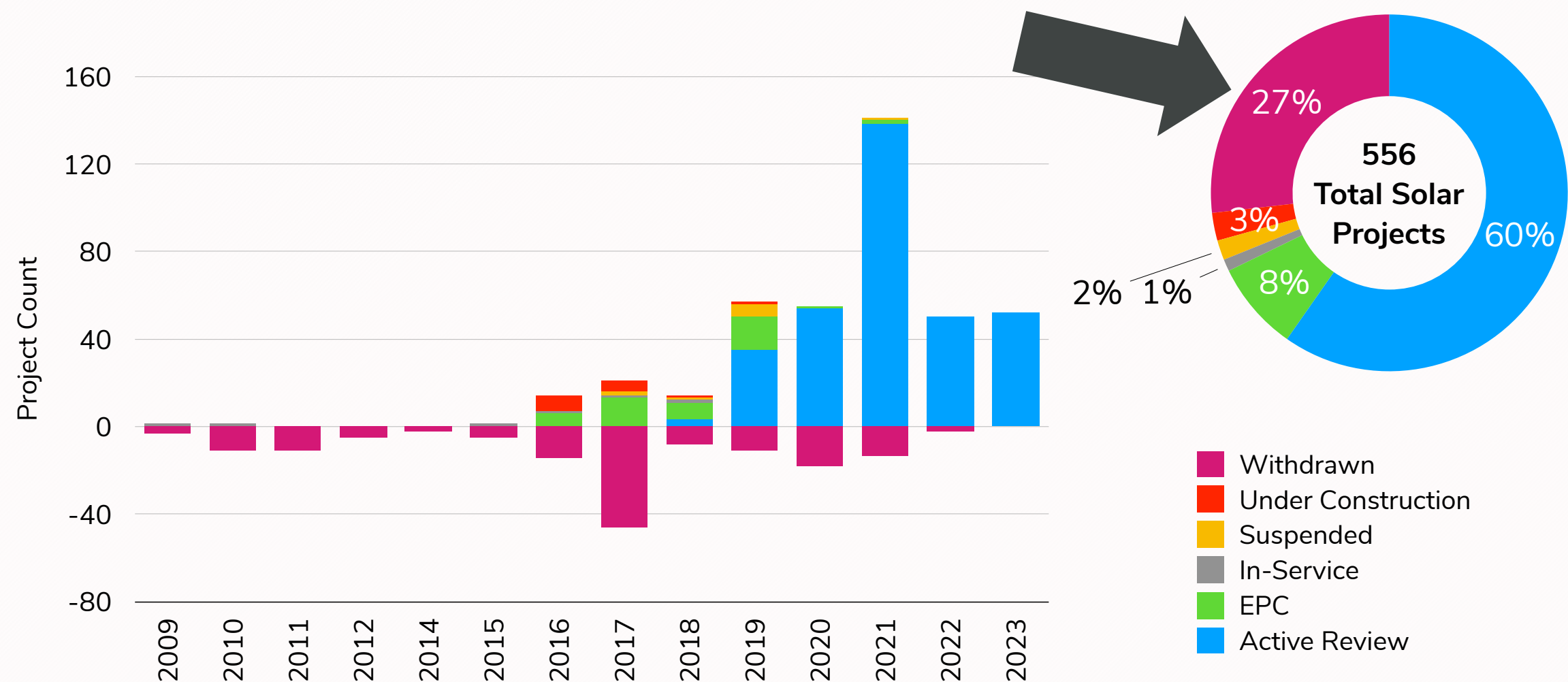
1. Madison - 20
2. Union - 17
3. Pickaway - 14
4. Hardin - 13
5. Van Wert - 13
6. Highland - 12
7. Champaign - 12
8. Marion - 11
9. Logan - 10
10. Ross - 9

**PJM Queue
Total:
387 Active
Projects**

Source: PJM -
<https://pjm.com/planning/services-requests.aspx>

PJM (Ohio) Interconnection Trends (by Queue Date)

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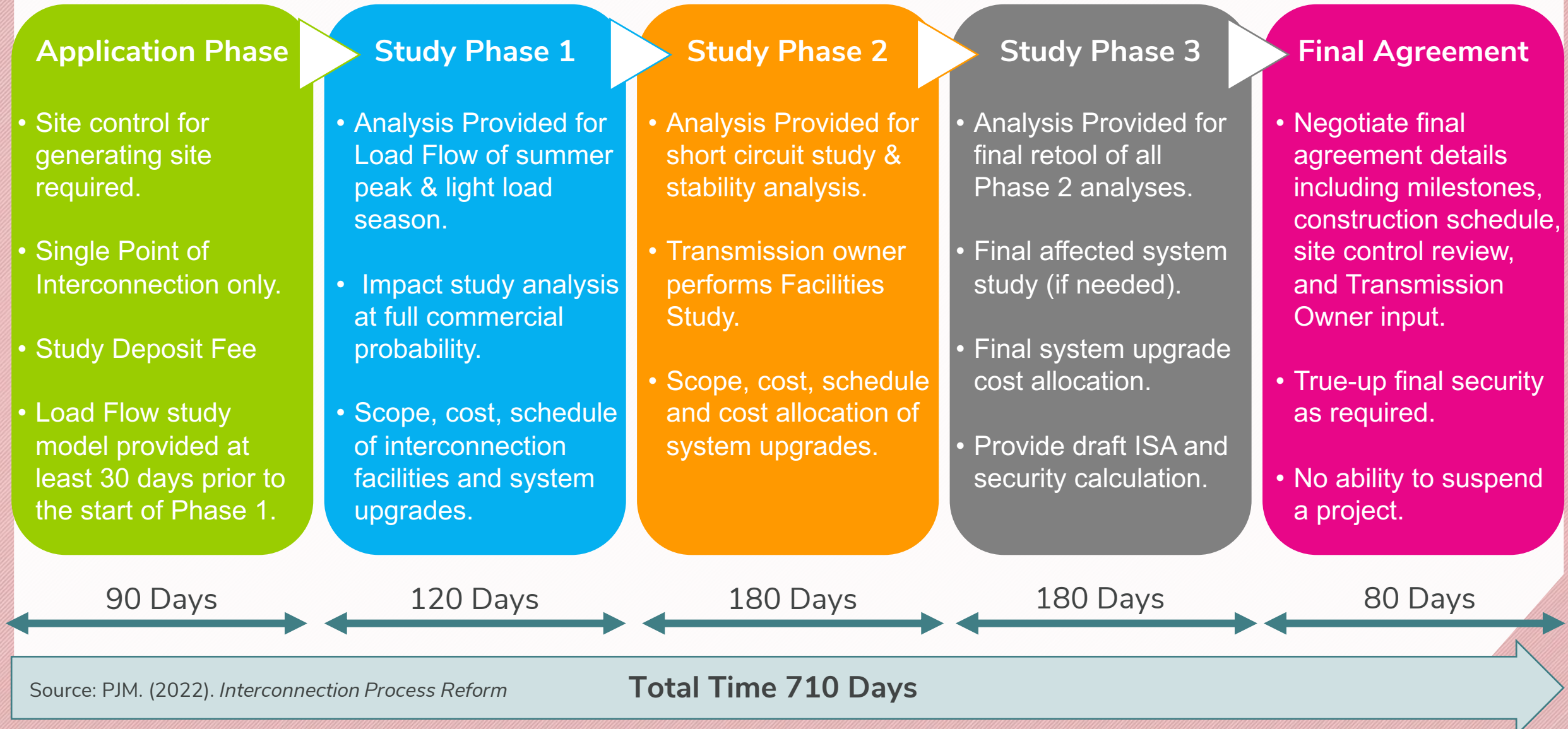


PJM Interconnection Process Reform

- PJM's interconnection process reform shifts from its prior "First-Come / First-Served" approach to a **"First-Ready / First-Served"** process.
- The reformed interconnection process aims **to reduce the # of speculative projects** that withdraw late in the process, causing backlogs.
- The revised interconnection procedures include **three study phases** followed by three Interconnection Customer (IC) decision points to evaluate the requests.
- Subsequent cycles "gated" by completion of phases in prior cycles.
- Revised application process outlines a formula for **larger, upfront study deposits**.

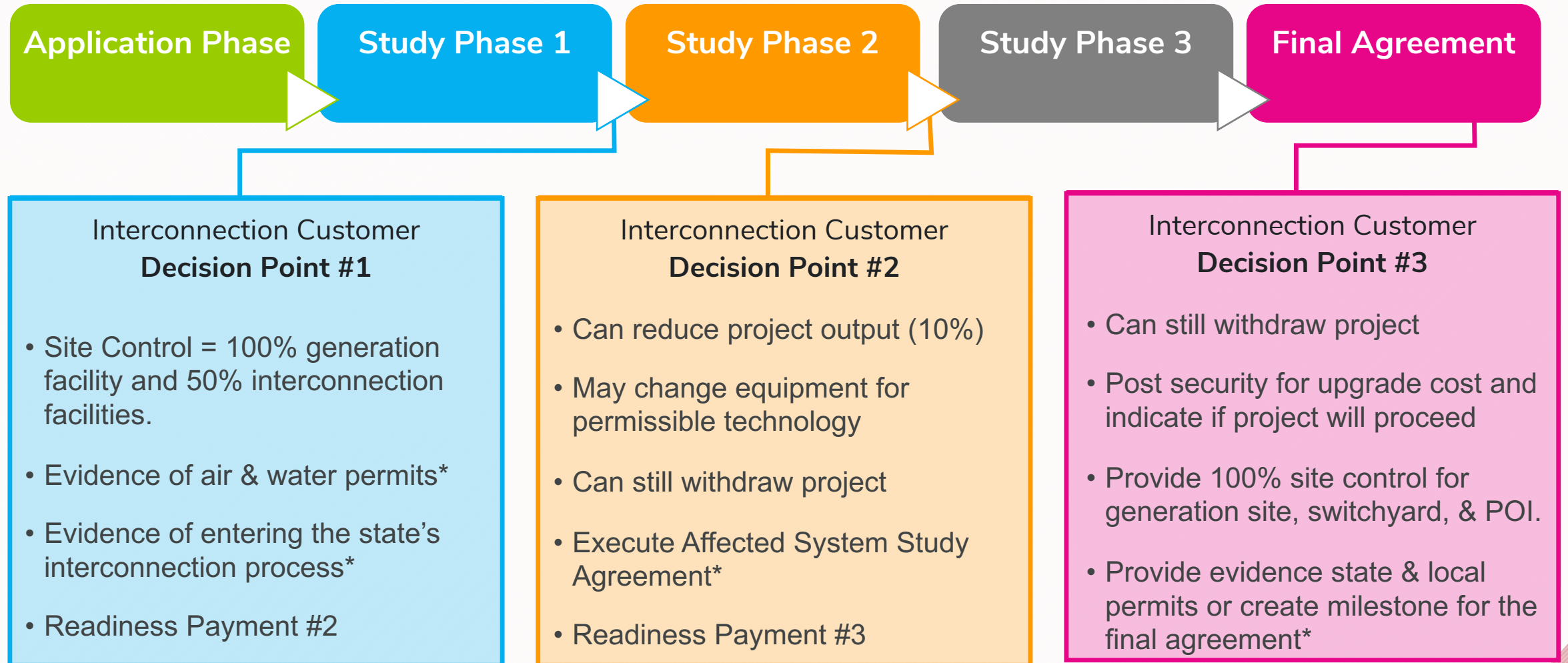
Key Phases of PJM Interconnection Reform

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Interconnection Customer (IC) Decision Points

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PJM Interconnection Process Reform:

Requirements for Site Control

SUBMISSION #1 – APPLICATION PHASE	
Full Site Control: <ul style="list-style-type: none"> 100% Generating facility: deed/lease/option 	Term Requirement: <ul style="list-style-type: none"> 1 Year from Application Deadline
SUBMISSION #2 – DECISION POINT 1	
Partial Site Control: <ul style="list-style-type: none"> 100% Generating facility: deed/lease/option 50% Interconnection Facilities: deed/lease/option/ROW 50% Interconnection Switchyard: deed/lease/option 	Term Requirement: <ul style="list-style-type: none"> Additional 1 Year from last day of Phase 1 1 Year from last day of Phase 1 1 Year from last day of Phase 1
SUBMISSION #3 – DECISION POINT 3	
Full Site Control³: <ul style="list-style-type: none"> 100% Generating facility: deed/lease/option 100% Interconnection Facilities: deed/lease/option/ROW 100% Interconnection Switchyard: deed/lease/option 	Term Requirement: <ul style="list-style-type: none"> Additional 3 Years from last day of Phase 3 Additional 3 Years from last day of Phase 3 Additional 3 Years from last day of Phase 3

PJM Interconnection Process Reform:

Calculating Readiness Deposits

- Application study deposit = (10% non-refundable)
 - Based on project size
- Phase 1 Readiness Deposit = (50% at risk)
 - \$4000 / MW
- Phase 2 Readiness Deposit (100% of Phase 1 RD at Risk)
 - 10% of Network Upgrade Costs minus RD1
- Phase 3 Readiness Deposit = (100% of Phase 3 RD at Risk)
 - 20% of Network Upgrade Costs minus RD1 & RD2

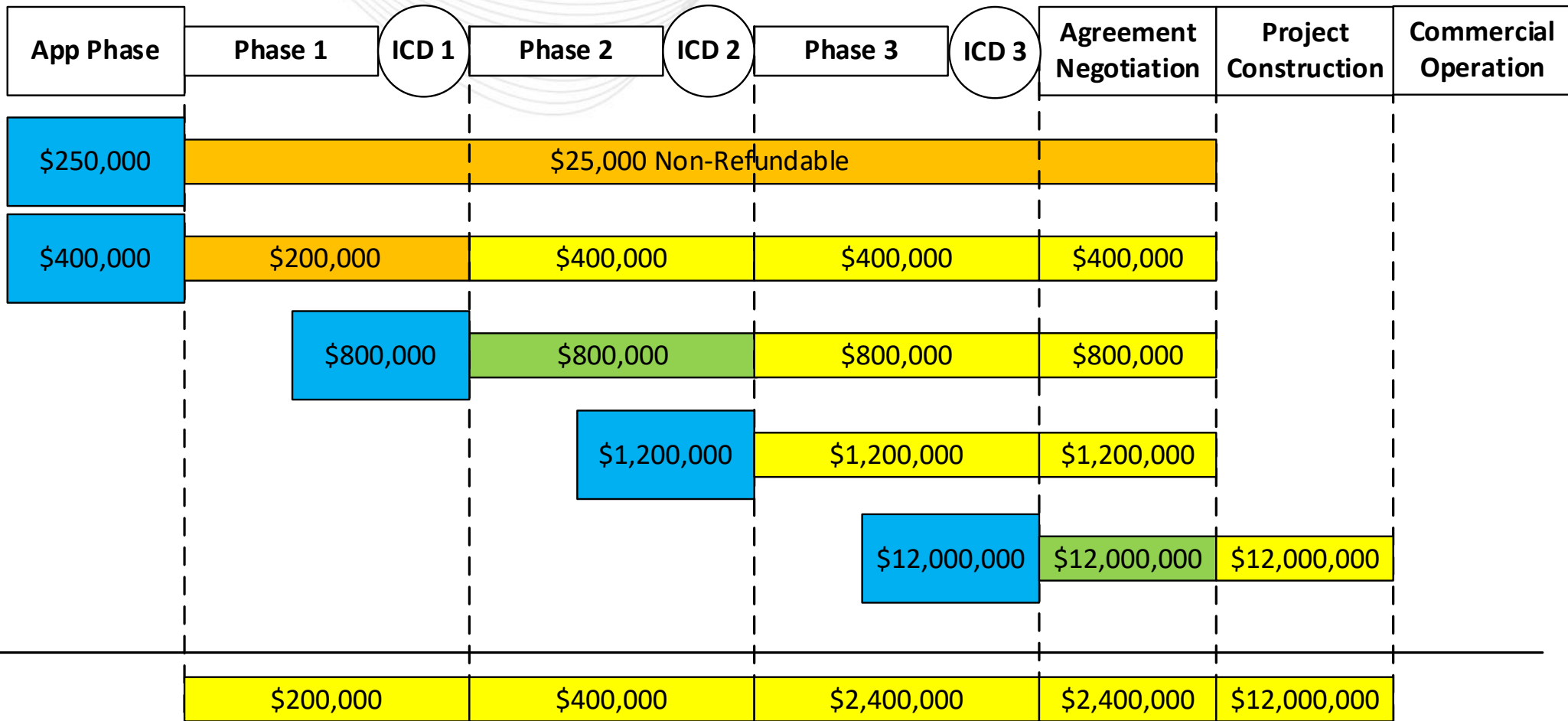
Application Deposit Table

Project Size	Study Deposit
0 - 20MW	\$75,000
> 20 – 50MW	\$200,000
> 50 – 100MW	\$250,000
> 100 – 250MW	\$300,000
> 250 – 750MW	\$350,000
> 750MW	\$400,000

Separate Treatment of Readiness Deposits and Security

Example

100 MW Project
\$12,000,000 Network
Upgrade Costs



■ Deposit not at risk ■ Deposit at risk
■ Deposit partially at risk ■ Payment due

IMPACT of New Interconnection Rules

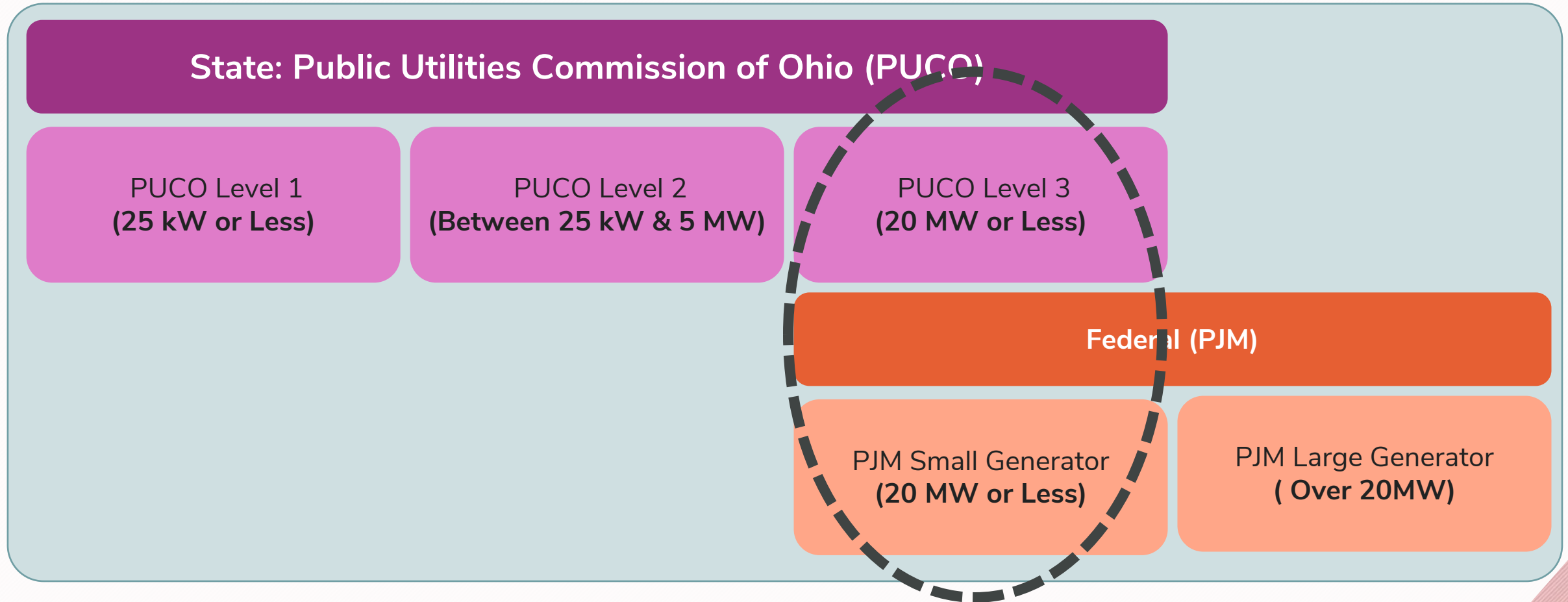
- PJM's interconnection reforms **should alleviate the interconnection queue backlog**, streamlining the interconnection process for new queue entries.
- Early phase readiness requirements including **higher fees / deposits and demonstration of comprehensive site control**, may dissuade developers from entering the interconnection queue.
- Developers are **no longer allowed to suspend** a project for up to 3 years, which will discourage speculative applicants.
- During the transition period, delays will likely continue with many projects being put on hold while PJM processes higher priority cycles.

Federal / State Jurisdiction and Closing Thoughts



Interconnection to the Electric Grid: Summary of Regulatory Oversight

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Electricity Jurisdictions

- The Federal-State regulatory jurisdiction dates back to the 1930s, when the Federal Power Act expanded the responsibilities of the Federal Power Commission to include:
 - **FEDERAL** oversight of wholesale electricity sales and transmission in interstate commerce
 - **STATE** oversight of retail sales and distribution of electricity.
- In 1977, Congress created the Federal Energy Regulatory Commission (FERC) to carry out the duties and authorities under Parts I and II of the Federal Power Act including:
 1. **Oversight of wholesale sales of electricity**
 2. **Transmission of electricity in interstate commerce**
 3. **The interconnected system of power plants and transmission lines**
 - In some cases, FERC jurisdiction may include electric generation systems units interconnected to distribution grid infrastructure that sells to wholesale markets.

Closing Thoughts

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- **Local Government** - lessons from the PJM interconnection process could inform local zoning regulations.
- **Local Residents** – provides clearer picture of the project development timeline.
- **Landowners Interested in Leasing** - better understanding of the transmission and distribution system helps assess project feasibility.
- **Ohioans** - helps to quantify the upstream development activity in the development cycle.



Image Source: Adobe Stock



Additional Resources, Questions, & Discussion



THE OHIO STATE UNIVERSITY
EXTENSION



Law bulletins and videos are available at:

OSU Farm Office
Energy Law
Library

OSU Extension
Energize Ohio

SCAN ME



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Questions and Discussion

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